“Working Memory Friendly Schools”

Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools

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Abstract

Background

Working memory is responsible for temporarily storing and manipulating information. Links between working memory difficulties and poor educational attainment have led to a rise in the development of costly and time intensive computer programmes that claim to train working memory ability, with inconsistent findings and limited transfer effects. To date, there has been little research into alternative systemic methods that can provide early intervention for students with working memory difficulties. This research is novel as it bridges the gap between empirical research and everyday application by using coaching psychology techniques with teachers to apply research-informed approaches about working memory in an educational setting.

Participants / Methods

Phase One of the research explored teachers' understanding of the term *working memory* and whether they adapt their teaching practices for students with working memory difficulties. 10 Key Stage Two teachers from five different schools (mainstream primary and additionally resourced provisions) participated in semi-structured interviews. Phase Two involved screening 19 pupils in Key Stage Two using the Working Memory Rating Scale (WMRS) and subtests from the Wechsler Intelligence Scale for Children fifth edition (WISC V) and the Wechsler Non-Verbal Scale of Ability (WNV) to identify students at risk of having working memory difficulties. Phase Three explored whether a coaching psychology intervention could be used with the teachers of those students to develop understanding of working memory, and implement research-informed approaches into their classroom teaching. Seven teachers across five schools engaged in three to four individual coaching sessions with a Trainee Educational Psychologist.

Analysis / Results

Qualitative and quantitative data was collected. Qualitative data was analysed using reflexive thematic analysis and quantitative data was analysed using descriptive statistics. The findings suggest that where there is a lack of teacher

knowledge regarding the term *working memory*, coaching psychology techniques can be used to improve teachers' understanding and identification using research based strategies. Raised teacher awareness had subsequent benefits for planning, classroom practice, professional development and self-efficacy. Despite many competing pressures, coaching was valued especially for the reflection and joint problem-solving opportunities provided.

Conclusions / Implications

The findings of this research highlight that through using coaching psychology techniques to support teachers, Educational Psychologists (EPs) can be agents of change. By "giving psychology away" and linking theory to practice through coaching, those who are best placed to create change within the educational system (such as teachers), are empowered and given the skills to respond. The implications of this research for Educational Psychology (EP) practice and avenues for future research are discussed. In particular, this research highlights the many opportunities for other EPs within the profession to diversify their practice, and adopt the use of coaching psychology techniques within their everyday work to promote working memory friendly schools.

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ABBREVIATION	
ARP	Additionally Resourced Provision
AWMI	Auditory Working Memory Index
CPD	Continued Professional Development
EHCP	Education, Health and Care Plan
EP	Educational Psychologist
SEN	Special Educational Needs
SENCO	Special Educational Needs Coordinator
SPSS	Statistical Package for the Social Sciences
TEP	Trainee Educational Psychologist
WISC V	Wechsler Intelligence Scale for Children Fifth UK Edition
WMI	Working Memory Index
WMRS	Working Memory Rating Scale
WNV	Wechsler Nonverbal Scale of Ability

Chapter 1 : Introduction

In this chapter, I will introduce my own background as a practitioner and researcher, and discuss my rationale for choosing this research topic. I will also provide a context for this research, including an overview of some of the commonly cited models of working memory. Finally, I will outline the aims of my research and the structure of this thesis.

1.1 My Background

I am a Trainee Educational Psychologist (TEP) on placement in an Outer London Borough in the South East of England. I am currently studying for a Doctorate in Educational, Child and Community Psychology at the University of Exeter.

My interest in working memory stems from my experience of working as an Assistant Educational Psychologist in an Outer London school for students with moderate to severe learning difficulties. Many students whom I worked with found retention and recall difficult and often struggled to hold multiple things in mind, for example when given a list of instructions. A session about working memory within my first year as a TEP particularly resonated with me as it enlightened me about the numerous research studies, most of which have focused on theoretical models outside of an educational context. In addition to the session about working memory, I also valued learning about consultation and the opportunities this can provide for joint problem solving and facilitating change.

As such, I decided to combine a problem that has been salient in my work as a psychologist (working memory), with the benefits that consultation and working systemically can provide. The positive, strengths-based and person-centred nature of coaching appealed to me as it aligns with my values and overlaps with consultation frameworks. Using coaching psychology techniques within this research has also enabled me to learn about the field in greater depth, and enhanced my own skills as a practitioner psychologist.

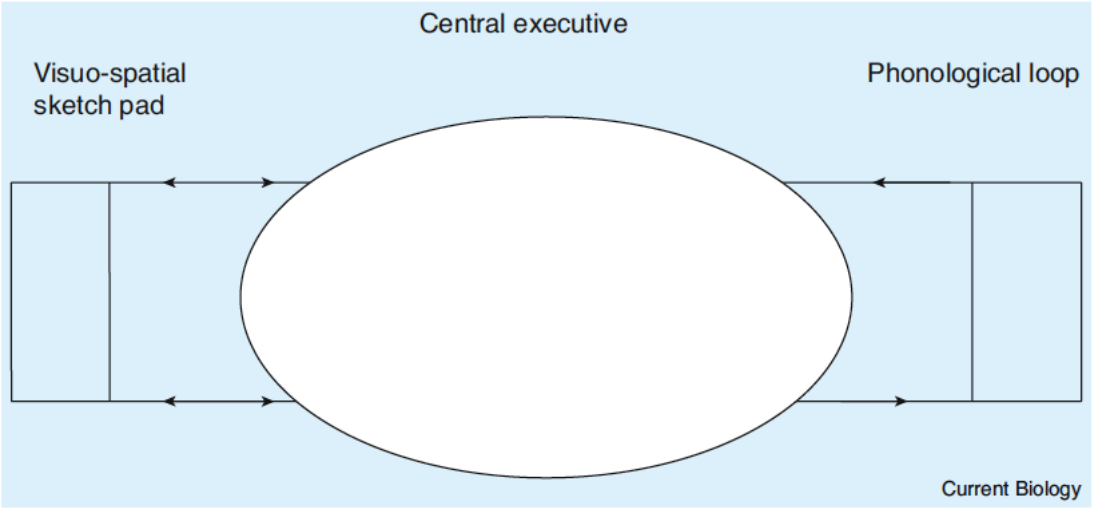
1.2 Introduction to Working Memory

Around seventy years ago, memory was thought to be a unitary store. Through evolving clinical case studies, memory was then suggested to be divided into components such as: sensory memory, short term memory and long term memory (Milner, 1966; Shallice & Warrington, 1970). These ideas of a trichotomy are reflected in early models of memory, such as the modal model of memory (Atkinson & Shiffrin, 1968).

Some believed however, that these ideas and models were too simple, and memory functions were further compartmentalised. This led to the idea of "working memory", a term first coined by Miller, Galanter and Pribram in 1960, which illustrated how short term memory could be broken down into many components. Baddeley and Hitch (1974) extended these ideas to develop their multi-component model of working memory. They argued that working memory was composed of three inter-related subsystems or components; the central executive, the phonological loop, and the visuo-spatial sketchpad (Baddeley & Hitch, 1974). These ideas are illustrated in Figure 1:

Figure 1

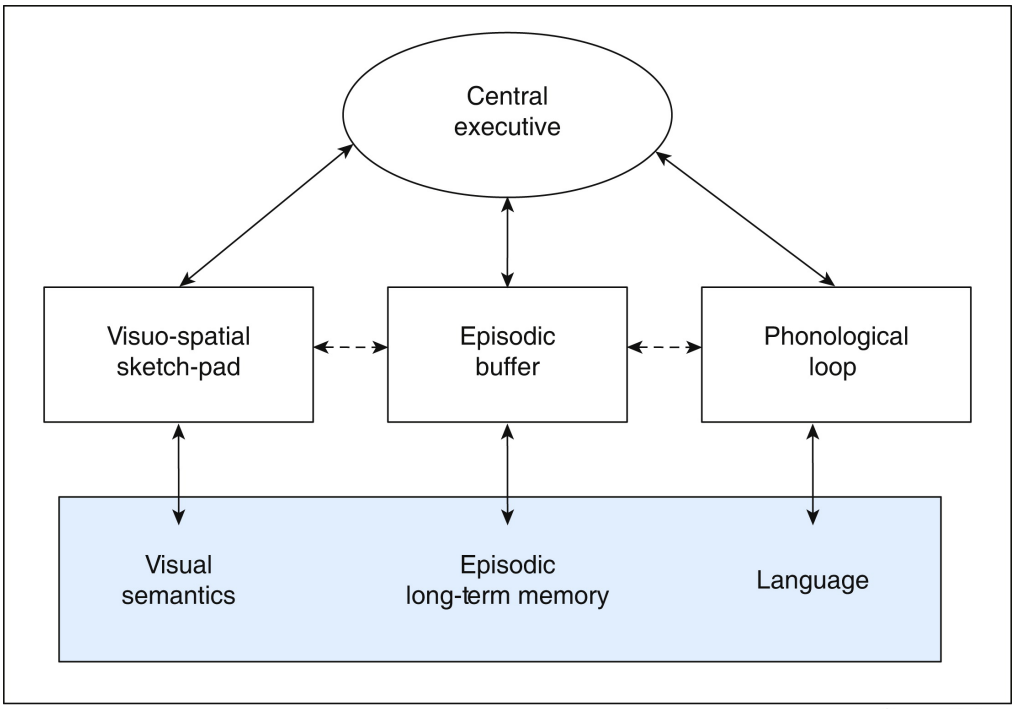
The original multi-component model of working memory proposed in 1974, taken from Baddeley (2010). This illustrates the three components (central executive, visuo-spatial sketch-pad and phonological loop).



Some neuropsychologists also support this idea and suggest that there is neuroanatomical evidence that these three functions operate in separate areas of the brain (Henson et al., 2000; Owen et al., 1996; Ravizza et al., 2004; Smith & Jonides, 1997). A fourth component was later added to the model by Baddeley (2000). This was referred to as the episodic buffer and believed to be a temporary storage component which integrates different types of information (see Figure 2).

Figure 2

The updated multi-component model of working memory, taken from Baddeley (2010). This illustrates the newly added fourth component: the episodic buffer.



Despite the elements in the model being componential, it is acknowledged that complex connections exist between each component (Baddeley, 2006). Each component of the model is explained in further detail in Table 1.

Table 1

Functions of each component, according to Baddeley (2006)

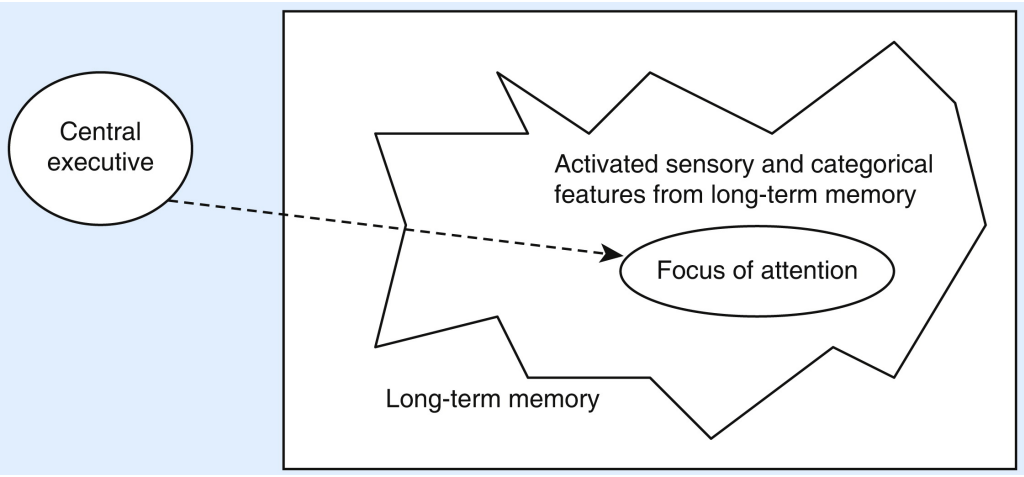
Component	Role / Functions
Central Executive	• This is an attentional control system, which selects and operates strategies. It is utilised when an individual has to store and process information. • Associated with regions within the frontal lobe (Chase et al., 2008). • Is considered to be a processing system for higher level cognitive processes (Baddeley, 1996; 1998).
Phonological Loop	• A system for holding and manipulating sound and speech. • Proposed to have two components: a store for holding phonological information, and a sub-vocal articulatory system. The sub-vocal articulatory system uses inner speech to rehearse items before trace decay occurs, and helps to explain why we have a limited digit span. For example, we find it easier to remember and recall a series of three digits, as the time taken to hear and rehearse the digits means that they will not have faded before the rehearsal process begins. But, as the length of digit sequences increases, it is difficult to rehearse all digits quickly enough before trace decay occurs. • Associated with functioning in the left temporoparietal region (Strand et al., 2008).
Visuo-Spatial Sketchpad	• The visuo-spatial sketchpad plays an important role in acquiring, holding and manipulating non-verbal material i.e. visual and spatial knowledge of the world. • The application of this component to education is still at a relatively early stage. • Primarily associated with areas in the right hemisphere of the brain (Osaka et al., 2007).

Component	Role / Functions
Episodic Buffer	• Introduced to illustrate that the central executive has a link to storage and is not purely an attentional system. • The episodic buffer is a multi-modal temporary storage system which integrates information from long-term memory and other components via the central executive. • Originally thought to be located in the hippocampus, although recent studies suggest that a number of brain areas may work together to give rise to the episodic buffer (Baddeley, 2001; 2013). • Argued to develop before children start school (Alloway et al., 2004).

Other theoretical models of working memory have also been proposed, including the embedded processes model by Cowan (1988; 2005). This model is illustrated in Figure 3 and suggests that working memory is an attentional system with a capacity of three to five items (Cowan, 2010; 2013). Short term storage of information and working memory depend on the activation of long-term memory representations. A subset of these activated memories are the focus of attention when activated by environmental stimuli. As such, the model is different to that proposed by Baddeley (2010) as there are no separate sensory modalities.

Figure 3

Cowan's model, as depicted by Baddeley (2010) which illustrates working memory being activated by features from long-term memory.



It is important to recognise that to date, the structure and function of working memory within the literature continues to be debated, although the multi-component model of working memory (Baddeley, 2000; 2010) is considered the most influential model. As such, this is the model that will be utilised and referred to during this research.

1.3 Aims of the Research

The aims of my research are firstly to explore teachers' understanding of working memory and whether they adapt their teaching practices for students with working memory difficulties. I will then examine whether a coaching intervention used with Key Stage Two teachers can develop teacher understanding of working memory and facilitate the use of research-informed approaches in their classroom teaching. For the purpose of clarity, my research will be split into three phases. The aims of each phase of my research are illustrated in Table 2 below:

Table 2.

Aims of the research, split by phase

Phase 1 Aim	Phase 2 Aim	Phase 3 Aim
To explore teachers' understanding of working memory, and whether they adapt their teaching practices for students with working memory difficulties.	To identify students for Phase 3 who may be 'at risk' of having working memory difficulties.	To explore whether a coaching intervention can be used with Key Stage Two teachers to develop their understanding of working memory, and implement research-informed approaches into their classroom teaching.

This chapter has provided an introduction to my research, with background information about working memory. Chapter 2 will examine the relationship between working memory and education in greater depth, and will present a review of the literature for both working memory and coaching. Chapter 3 will then detail my methodology and methods, before Chapters 4, 5 and 6 present the findings from each phase of my research. My final chapter (Chapter 7) will integrate and discuss the findings from all three phases, before addressing the limitations of the research, implications for educational psychology practice and avenues for future research.

Chapter 2 : Literature Review

In this chapter, I will consider published literature on working memory and coaching including; why working memory is important within education, how working memory is assessed and whether working memory can be trained. I will then explore other ways that working memory may be supported, including through the use of coaching psychology. I will conclude by identifying the current gap in the literature.

2.1 Literature Review Search Strategy

When reviewing the literature on working memory and coaching, published information from journals, articles and books was drawn upon. Searches were carried out within specific journals such as Educational Psychology in Practice, as well as through other electronic databases. These databases included: APA PsychNet, PubMed, ProQuest, ScienceDirect, Springer Link Open Access, Sage Journals, Taylor & Francis Online, Wiley Online Library, Web of Science, Scopus, Elsevier, Education Resource Information Centre (ERIC) and EBSCO. Literature was also identified from journal articles that had cited or referenced other sources. In addition, information from the Department for Education was used, along with Google and Google Scholar. Literature was searched from the earliest dates available through to June 2020.

Due to the broad nature of coaching and working memory, I focused my research on children and young people in the context of educational settings such as schools. As such, the following search terms were used in various combinations; “working memory”, “education”, “coaching”, “psychology”, “classroom”, “school”, “children” and “teachers.” Searches returned a wide and comprehensive range of literature, so each paper’s title and / or abstract was appraised to identify its potential value and relevance to my research. The literature search primarily identified; i) the definition of working memory and relevant theory, ii) the development of working memory skills in children, iii) the implication of working memory skills for education and learning, iv) ways to assess working memory difficulties, v) methods for training and improving working memory, and vi) coaching psychology in relation to education.

2.2 Applying Working Memory Models to Education

Over the past twenty years, researchers have attempted to apply concepts from the multi-component model of working memory (Baddeley and Hitch; 1974; Baddeley, 2000) to learning and education. Within the United Kingdom, researchers such as Gathercole and Alloway have extensively explored the links between working memory and education. According to Gathercole and Alloway (2004), working memory is defined as "the ability to hold and manipulate information in the mind for a short period of time" (p.2). Alternative definitions describe working memory as the brain's post-it note and a system where we mentally record what we need to remember, and then manage this information (Alloway & Alloway, 2014). Although the body of research that examines working memory within education has spanned three decades, the importance of working memory within education continues to be noted, specifically for multi-tasking (Covre et al., 2019).

There has, however, been some criticism of applying working memory models such as those developed by Baddeley and Hitch (1974) to learning and education. For example, Baddeley (2006) and Apter (2012) highlight the difficulties of adapting a model originally developed to facilitate experimental research, and applying this to studying learning and memory in a classroom. Others note how factors such as processing speed, distraction and information decay should be considered when evaluating working memory (Bayliss & Jarrold, 2015; Jarrold, 2017). It has also been suggested that working memory sits under a broader umbrella of executive skills (Dawson & Guare, 2018), and there are many other skills alongside working memory necessary for planning, metacognition, task initiation, flexibility and response inhibition. As such, it is argued that we have to consider these executive functions, as well as other factors such as processing speed, distraction, information decay and attention, because they cannot be separated from working memory (Awh & Jonides, 2001).

2.3 The Development of Working Memory in Children

Working memory is believed to begin developing before children start school (Alloway et al., 2004). It is understood that this development continues through childhood and adolescence, but reaches a plateau around the age of sixteen (Conklin et al., 2007; Gathercole et al., 2004a; Luciana et al., 2005; Malekpour et al., 2013). Some researchers such as Klingberg (2006) have examined the areas of the brain involved in working memory development, and note that the development of parietal-frontal pathways throughout childhood and adolescence are associated with visuo-spatial working memory functioning. Others such as Van 't Wout et al. (2019) also suggest that younger children have reduced working memory capacity, particularly for procedural information such as task rules but this develops with age. Such findings therefore illustrate the developing nature of working memory over the course of childhood.

Specific abilities of working memory may also develop at different times. For example, it has been suggested that children younger than seven years old do not reliably engage in the spontaneous rehearsal of auditory information, but as they develop in age, they become aware of the benefits that rehearsing information can provide (Gathercole et al., 1994). Other researchers have examined rehearsal and recall in young children (Jarrold, 2017), with some suggesting that between the ages of five and ten, children shift from relying on visual information and begin to rehearse and recode in a phonological form (Gathercole et al., 1994; Hitch et al., 1988). These findings are significant given that in recent years, Ofsted (2017) have recommended increased formal teaching of reading, writing and mathematics in Reception. As this would be in place of learning through play and other visual measures, it may be detrimental to the benefits that these types of learning can provide (Pierlejewski, 2018; Walsh et al., 2010). Other research has reported links between poor verbal working memory and learning difficulties (Henry, 2001; Malekpour et al., 2013; Van der Molen et al., 2014). It is possible that this childhood shift from visual recall to verbal recall may be significant, and if children struggle with this transition, then difficulties with working memory may emerge.

As such, the research suggests that working memory develops between the ages of pre-school to adolescence, with many specific shifts also taking place during this time. It could, therefore, be argued that there is a sensitive or critical period (Knudsen, 2004) for working memory to develop. If this is the case, then primary school education may provide the opportunity to target those who have poor working memory before their ability begins to plateau.

2.4 Working Memory in the Classroom

There are many everyday classroom activities that place demands on a child's working memory (Pickering, 2006). Alloway and Alloway (2014) detail how important both verbal working memory and visuo-spatial working memory are within the education context. They state how children use verbal working memory to remember and carry out a two or three part instruction, copy text from the board, and complete reading comprehension tasks. Visuo-spatial working memory is used to complete mental maths problems and sequencing tasks.

Early identification and intervention of poor working memory is significant given the associations between poor working memory and lower attainment (Alloway, 2006; Fitzpatrick & Pagani, 2012; Hall et al., 2015; Willoughby et al., 2019). This includes lower attainment on National Curriculum levels (Gathercole & Pickering, 2000; Gathercole et al., 2004b; Jarvis & Gathercole, 2003). As Gathercole (2008) highlights how children who have poor working memory may have missed opportunities due to their inability to access lessons, some have produced a list of behaviours that may typically be observed in the classroom for a child with poor working memory (Evely & Gamin, 2013; Gathercole & Alloway, 2007). These behaviours include the child:

- Appearing inattentive, easily distracted and perhaps daydreaming or appearing like they are not listening.
- Forgetting what they have been taught or what they have done in previous lessons.
- Rarely volunteering to answer questions or contribute to class discussions, and sometimes not answering direct questions.

- Making poor progress, particularly in reading and mathematics.
- Forgetting instructions that have two or more parts.
- Losing their place in complicated tasks.
- Not seeing tasks through till completion.
- Displaying difficulty copying information from a board to their book.
- Having difficulty beginning a task independently.
- Lacking confidence or becoming frustrated with themselves as a learner, which may result in challenging behaviour.

In the following sub-sections, I will examine how working memory links with different aspects of learning and attainment in more detail:

2.4.1 Working memory difficulties and literacy

Many studies have found links between a child's working memory ability, and their vocabulary, acquisition of language and their reading ability (Morra & Camba, 2009). Other studies also highlight how memory (including working memory), is involved in the processes of reading (de Jong, 2006). For example, in early literacy development when letters and sounds are novel, a child is required to turn each letter (grapheme) into a corresponding sound (phoneme). Children are then required to hold these phonemes in mind after decoding, and then blend them together in order to form a whole word.

Research conducted by de Jong and Olson (2004) looked at the relationship between memory and literacy with 77 Dutch kindergarten children. They found that phonological memory was involved in the development of letter knowledge, and vocabulary. These findings link with other research which suggests that the phonological loop contributes to the acquisition of grammar and early stages of reading (Baddeley et al., 1998).

Alongside the associations between working memory and decoding, some have examined the relationship between working memory and reading comprehension (Cain, 2006; Swanson, 1994). Comprehension of text may also require a child to use working memory because after the text has been decoded, the child is

required to hold information in mind whilst working out how it fits together and make sense of the text as a whole. These ideas are reflected in a meta-analysis of 6,179 participants across 77 studies conducted by Daneman and Merikle (1996), which suggests that comprehension requires combined aspects of processing and storage, rather than storage alone. This therefore highlights the importance of working memory in relation to literacy, not only for decoding text but also for comprehension.

2.4.2 Working memory difficulties and mathematics

Similarly to literacy, it has been suggested that a child's working memory ability is linked with calculation, problem-solving and overall performance in mathematics (Allen et al., 2019, 2020; Bull & Scerif, 2001; Calderón-Tena, 2016; Malekpour et al., 2013; McLean & Hitch, 1999; Swanson, 1994). Research by Nyroos and Wiklund-Hörnqvist (2012) examined the relationship between working memory capacity and mathematical performance and found that working memory was a predictor for mathematical ability and most basic mathematical competencies. This is in line with findings from other studies which also suggest that working memory is important in mathematics as strategies including problem solving and mental arithmetic load heavily on working memory resources (Carden & Cline, 2015; Hecht, 2002).

Nyroos and Wiklund-Hörnqvist (2012) argue that mathematics utilises working memory due to the simultaneous processing and storage of information skills that are associated with mathematical operations. As processing and storage are both facilitated by the central executive, some suggest that children who present with mathematical difficulties have limited central executive functioning, and therefore find it hard to utilise executive functions such as attention or task switching (Geary, 2004). Some research suggests that in order to compensate for such difficulties, children with impairments on verbal working memory would be helped by concrete resources, whereas those with impairments on visuo-spatial working memory may benefit from using rehearsal strategies (Nyroos & Wiklund-Hörnqvist, 2012).

2.4.3 Working memory difficulties and other special educational needs (SEN)

Figures from the Department for Education (2018) indicate that 14.6% of pupils have a special educational need, comprising 2.9% who have an Education, Health and Care Plan (EHCP) and 11.7% receiving SEN support. Alongside these figures, Alloway et al. (2009a) screened 3,189 children aged five to eleven and found that almost 10% were identified as having very low working memory scores. This therefore illustrates the possible co-morbidity of working memory difficulties with other special educational needs. Some authors even suggest that working memory should be assessed whenever a child is referred with a possible learning difficulty (Malekpour et al., 2013).

Other research also makes links between poor working memory and learning difficulties or developmental language impairments (Henry & Botting, 2017; Hutchinson et al., 2012; Swanson & Siegel, 2001). Links have been made between poor working memory, poor inhibition and conditions such as attention deficit hyperactivity disorder (ADHD), Fragile X Syndrome, Williams Syndrome or Down's Syndrome (Cornish et al., 2006; Fosco et al., 2020; Jarrold, et al., 1999). For other types of special educational needs such as children who are deaf, it has been suggested that they may have enhanced visuo-spatial working memory abilities due to learning sign language (Keehner & Atkinson, 2006).

Others have explored the link between working memory and learning difficulties in more detail and have looked at IQ levels. For example, Henry (2001) studied working memory difficulties in those with "borderline learning difficulties", "mild learning difficulties" and "moderate learning difficulties." The research found that working memory may be linked to IQ, especially for complex memory span tasks involving the central executive. The research also highlighted that without any other processing taking place, children aged 11-12 who have a moderate learning difficulty could retain three units of information, compared to "normal" children who could retain five units. When there was interference or other processing demands, for example noise in a classroom, this lowered and those with moderate learning difficulties retained one unit of information, compared to their "normal" peers who could maintain three. Such findings for "normal" children's working memory capacity are broadly in line with those proposed by Miller (1956).

It should be considered however, that the labels used within this research to classify learning difficulties may be problematic. For example, some researchers suggest that labels such as “moderate learning difficulties” are inconsistent and not well-understood (Norwich et al., 2012). In addition to this, the overlap between working memory difficulties and learning difficulties means that there is not a clear direction of causality between lower IQ and working memory difficulties.

Research conducted by Alloway et al. (2009c) examined whether memory performance varied according to the different types of stated special educational needs that children had. They studied children with ADHD, developmental co-ordination disorder (DCD), specific language impairments (SLI) and those with a diagnosis of Asperger’s syndrome. Their findings indicated that those with SLI or Asperger’s were weak on verbal tasks, those with DCD performed poorly on all tasks (including visuo-spatial tasks), and those with ADHD performed poorly, possibly because they struggled to attend to the information. These findings are similar to those reported by Pickering and Gathercole (2004) who assessed the working memory skills of four categories of children; those with general learning difficulties, language problems, literacy problems, and attentional and behavioural problems. In their research, Pickering and Gathercole (2004) found that children with general learning difficulties performed poorly on measures that map onto all components of the working memory model: the phonological loop, central executive, and the visuo-spatial sketchpad. However children with language difficulties only showed impairments on tasks that mapped onto the phonological loop and the central executive, whereas those with literacy difficulties or behavioural problems fell within the normal range on the tasks. The findings from these two studies are perhaps unsurprising given the nature of each difficulty, but suggest that the type of difficulty a child has may link with difficulties on specific aspects of working memory.

2.5 Assessing Working Memory Difficulties

Given the importance of working memory on many aspects of learning, some have attempted to measure and standardise working memory in an attempt to identify those who are at risk. Aspects of the British Ability Scales (BAS) claim to measure working memory using forward and backwards digit span, although it is argued that only backward digit span is a reliable and sensitive measure of working memory in children (Gathercole, 2008; St Clair-Thompson, 2010). The use of digits may also be problematic as it relies on an assumption of numerical knowledge and understanding and may only measure functioning of the phonological loop (Pickering, 2006). As such, Gathercole (2008) argues that there are better measures to assess working memory without sole reliance on digit stimuli. These include; the Working Memory Test Battery for Children (WMTB-C: Pickering & Gathercole, 2001), which is comprised of ten subtests and is argued by Gathercole et al. (2004a) to map well to the working memory model (Baddeley & Hitch, 1974), and the Automated Working Memory Assessment (AWMA: Alloway, 2007). At the current time of writing, the WMTB-C is out of print and the AWMA has been withdrawn, and the reasons for this are unclear.

Available alternatives to the WMTB-C and AWMA include the Wechsler Intelligence Scale for Children (WISC) and the Wechsler Nonverbal Scale of Ability (WNV). The Wechsler Intelligence Scale for Children Fifth Edition (WISC V: Wechsler, 2016) is an assessment measure for students aged 6-17, designed to assess cognitive ability. The WISC V introduced the Picture Span subtest alongside other digit span subtests, and is therefore argued to assess visual working memory as well as auditory working memory (Wechsler, 2016). This is of particular importance given that Baddeley (2010) suggests that working memory has two sensory modalities: an auditory modality (the phonological loop) and a visual-spatial modality (the visuo-spatial sketchpad). The Spatial Span subtests used in the WNV are also argued to be a good measure of visual-spatial working memory (Wechsler & Naglieri, 2006). As such, using the WISC V alongside the WNV would ensure that both the auditory and visual spatial modalities of working memory were assessed, in line with Baddeley's (2010) model. As the WISC V is still a relatively new edition, there has not been any research conducted to date that has examined the relationship between the

WISC V and WNV, although both assessments are considered to have convergent validity with other working memory measures (Wechsler, 2016; Wechsler & Naglieri, 2006). In addition, the WISC V and WNV use the same norm descriptors category, allowing for ease of comparison between both assessment measures.

Other tools have been developed to allow teachers to screen for students who may have potential working memory difficulties. These include the Working Memory Rating Scale (WMRS: Alloway et al. 2009b), Lucid Recall (GL Assessment, 2017) and the Working Memory Power Test for Children (WMPT: Chalmers & Freeman, 2018, 2019). However, it should be noted that the WMPT has been researched in Australia and is only available to purchase in that country. The WMRS on the other hand is currently available for use within the UK and is claimed to have good internal reliability, construct validity and convergent validity with the Wechsler Intelligence Scale for Children Fourth Edition (Alloway et al., 2009b). As such, the WMRS currently appears to be the most efficient and widely available screening tool for working memory difficulties within the UK.

It should be noted however, that the attempts made by some to standardise working memory has led to measures for visual and auditory working memory on the Lucid Cognitive Profiling System (CoPS: GL Assessment, 2017), being used to attempt to predict later learning difficulties. Marks and Burden (2005) conducted a small-scale longitudinal investigation and found links between poor scores on the CoPS and later difficulties with learning. They highlight however, the dangers of over-generalisation and suggest that any predictions should be made with caution because other skills such as attention, comprehension and processing speed may also contribute to learning difficulties.

2.6 Attempts to Train Working Memory

With the increase in standardised measures that claim to measure working memory, there has also been an increased body of research examining whether working memory can be improved through training programmes in schools. The findings of many studies are inconsistent and reflect the on-going debate within the literature about whether working memory can be trained. For example, some

studies report that the use of training programmes such as Cogmed (Cogmed, 2016) and Lucid Memory Booster (GL Assessment, 2017) can improve IQ and working memory (de Jong & Smit, 2020; Hessl et al., 2019; Holmes et al., 2009; Roche & Johnson, 2014; St Clair-Thompson & Holmes, 2008; Wiest et al., 2020).

When scrutinising the efficiency of such interventions, there are some factors that should be considered. For example, recent research by the Education Endowment Foundation (2019) suggests that children who engaged in an Improving Working Memory intervention or a Working Memory Plus intervention did make progress in relation to their numeracy skills. However, there was a significant amount of adult support needed to facilitate this intervention. Others also suggest that although working memory training programmes can demonstrate improvements on aspects of verbal working memory, visuo-spatial working memory or storage, these improvements may not be reflected in other aspects such as processing, verbal ability, word reading and arithmetic (Chacko et al., 2014; Melby-Lervåg & Hulme, 2013; Skelton & Atkinson, 2017). Furthermore, other research studies suggest that any gains or improvements in working memory ability are task-specific and do not have any transfer effects for other situations, or standardised assessments (Kassai et al., 2019; Mawjee et al., 2015; Nelwan & Kroesbergen, 2016; Redick et al., 2015; St Clair-Thompson et al., 2010).

In light of the on-going debate, Melby-Lervåg and Hulme (2013) attempted to clarify the success of working memory training programmes and conducted a meta-analysis of twenty-three studies, examining the success of training programmes such as Cogmed, Cognifit and Jungle Memory. The results indicate that there are some short-term benefits for both verbal and visuo-spatial working memory, although these benefits were not found to be transferable. The authors also question whether working memory training programmes focus primarily on improving cognitive load, and do not consider the role of other executive functions such as attention. Similar concerns have been raised by Apter (2012) who states that the evidence for computerised training programmes such as Cogmed (Cogmed, 2016) and Jungle Memory (Memosyne Ltd., 2011) is weak. He argues that one of the reasons for this is due to the over-application of Baddeley and Hitch's working memory model, given that it was originally designed to facilitate

experimental research. As such, he argues that it is not intended as a framework for improving working memory and should not be used for this purpose. Pickering (2006) also makes reference to the gap that exists between working memory training programmes and assessment batteries used to measure working memory.

It could therefore be argued that working memory programmes either focus heavily on improving specific aspects of working memory such as load and storage, ignore other factors such as attention, require large amounts of adult facilitation, or have a narrow focus on a particular task (which makes generalising the skill outside of the training situation difficult). In addition to this, over application of frameworks and models make it difficult to link what is known experimentally, with how working memory operates in the context of a classroom environment.

2.7 Other Ways to Support the Development of Working Memory

Based on the research considered so far, there appears to be a link between poor working memory and learning difficulties within the classroom. But, given the inconsistent results from working memory training programmes, it is important to consider how we may help address working memory difficulties using alternative interventions.

Some have highlighted the importance of visuo-spatial memory within the classroom and therefore suggest that visualisation strategies can reduce demand and improve memory (Bagri & Jones, 2018; Carden & Cline, 2015). Given the shift that takes place in children from visual recall to verbal recall between the ages of five and ten years old, visualisation strategies may be helpful for children who struggle with this transition. Davis and Bamford (1995) also suggest that concrete apparatus can aid mathematical learning and assist children in solving simple arithmetic problems. Adopting visual or kinetic resources such as Numicon may therefore be beneficial. Others detail how motivating children with points and rewards may help them to prioritise more valuable information (Atkinson et al., 2019).

In terms of developing learning skills, Dehn (2008) and Jones et al. (2019) also stipulate the importance of teaching meta-cognitive skills. Metacognition refers to higher level thinking and involves the knowledge people have about their cognitive abilities and cognitive strategies (Flavell, 1979). In other words, metacognition may be defined as "the monitoring and control of thought" (Martinez, 2006) and may control behaviour (Rhodes, 2019). In the context of a school classroom, this may involve a child being aware that they struggle to remember instructions unless they are in a visual format. Sternberg (1997) argues that metacognitive knowledge and skills are essential for learning as they guide a child's choice of strategies. The Education Endowment Foundation (2020) recognises the importance of teaching metacognitive strategies, and argues that pupils make greater progress when teachers explicitly teach metacognitive strategies such as planning, monitoring and evaluating learning.

Others also argue that the training of metacognitive skills and strategies such as chunking and rehearsal may improve working memory performance (Caviola et al., 2009; Dehn, 2008; Jones et al., 2019) and increase academic achievement (Freeman et al., 2017). Apter (2012) similarly argues that explicit teaching of memory skills, memorisation and recall may be beneficial. Such suggestions link with programmes developed in Australia such as "Memory Mates", which attempt to teach the student strategies to support with any memory difficulties they may be experiencing (Colmar & Double, 2017). Within the United Kingdom however, the majority of working memory research conducted to date has adopted a medical model stance. The numerous tests available to standardise working memory and the costly and time intensive training programmes place a large emphasis on working memory being regarded as a "within-child" difficulty.

Some have attempted to shift this focus away from the child and consider working memory difficulties within the wider classroom environment by raising teacher awareness. For example, Gathercole and Alloway's (2007) "Understanding Working Memory: A Classroom Guide" is a teacher friendly guide that attempts to illustrate how children with working memory difficulties may present in the classroom and considers how the teaching and learning environment can be adapted to support such students. However, despite this attempt at increasing teacher awareness through publications, there is little research that has

examined how this information is then translated into teachers' pedagogic practice. Coupled with research which suggests that teachers' awareness of working memory difficulties is poor (Alloway et al., 2012), this means that there is a gap between the empirical research knowledge and the real-life everyday application. Recent research by Norwich et al. (2018) looked at whether a lesson study approach using working memory ideas could improve teachers' knowledge and practice. The research highlights the benefits of educational psychologists working with teachers to deploy their psychological knowledge, although also illustrated the complexities and organisational challenges for teacher collaboration. As such, it could be explored whether this gap between the empirical research and the real-life application could be bridged using approaches such as coaching. This could be undertaken with individual teachers to educate them about working memory difficulties and develop their teaching practice, in order to apply strategies from working memory research within a classroom environment.

2.8 Coaching Psychology

Coaching is a relatively new sub-discipline in psychology, having developed over the past twenty years. Although some applications of psychology and coaching can be traced back to team sports in the 1950's (Lawther, 1951), coaching psychology was not recognized as a formal discipline within the British Psychological Society (BPS) until 2004. Since this recognition, coaching psychology has grown in popularity and has developed into an international discipline with a growth in literature and research base (Adams, 2016). It is important to note that there is a distinction between a "coaching psychologist" (someone who has trained in coaching), and the broader term "coaching psychology" (Adams, 2016; Passmore et al., 2018). This therefore means that the term "coaching psychology" can be applied to a wide range of work carried out by different professionals. For the purposes of this literature review, I will refer to literature that encompasses the broader term "coaching psychology." The definition of coaching I will be subscribing to throughout the thesis is that from The Association for Coaching who define coaching as "a facilitated, dialogic and

reflective learning process that aims to grow the individuals awareness, responsibility and choice" (Association for Coaching, 2020).

According to Munro (1999), coaching differs from other types of intervention due to the focus on common goal setting, limited duration, focus on self-motivation, the aim to increase learner awareness, and the relationship and respect about what the coachee already knows. Others acknowledge that whilst there are some similarities between consultation and coaching within educational psychology practice, there are also a number of differences (Passmore & Lai, 2019; Ryan, 2018). As such, Adams (2016) argues that coaching should be regarded as "a distinct branch of academic and applied psychology that focuses on the enhancement of performance, development and well-being" (p. 232). Research conducted by Ryan (2018) outlined several key differences between coaching and consultation. Firstly, coaching involves two people working together, whereas consultation often involves more than two people working together. Secondly, coaching often involves direct engagement with the person who will be changing as a result of the coaching, whilst consultation works with a client to change the situation of a third party. Finally, consultation may involve EPs offering suggestions to help solve the problem, whereas coaching is focused on drawing upon and valuing what the coachee already knows.

A key aspect of coaching psychology involves applying established psychological models and principles to underpin the work (Palmer & Whybrow, 2007). Such models and principles may include person-centred approaches (Rogers, 1961), solution-focused brief therapy (Berg & De Jong, 2002; de Shazer, 1985, 1988), self-determination theory (Ryan & Deci, 2000), self-efficacy theory (Bandura, 1977; Maddux, 2005) or mindfulness (Passmore, 2017). Adams (2016) also outlines how there is scope for more tailored and specified approaches for individuals who may struggle with commitment to change, or who may be prone to thoughts and behaviours which limit their practice and development. For these individuals, approaches such as motivational interviewing (Miller & Rollnick, 2002) or cognitive-behavioural coaching approaches (Libri & Kemp, 2006; Neenan & Palmer, 2012) may be used. Some suggest that the effectiveness of coaching is greatest if coaches can hold multiple models or approaches in mind (Kauffman & Hodgetts, 2016).

Several studies have found that coaching psychology can increase self-efficacy, and highlight the benefits of enhancing self-efficacy as a protective factor (de Haan et al., 2016; Franklin & Doran, 2009; Lee et al., 2013; Moen & Allgood, 2009). Specifically, de Haan et al. (2016) found that coachee perceptions of success and a strong working alliance with the coach mediated the impact of coaching on self-efficacy levels. Similarly, Adams (2015) notes the significance of the coach / coachee relationship to facilitate success experiences and support the coachee to transfer existing skills. This research therefore illustrates the importance of the coaching alliance to enable mastery experiences and performance accomplishments to occur (Bandura, 1977a, 1997).

In addition to the effects on self-efficacy, coaching psychology can also have a positive impact on well-being, goal attainment, resilience and performance (Grant, 2017; Lawton Smith, 2015; Linley et al., 2010). Specifically, within the context of education, coaching has been reported to have a positive impact for both students and teachers. Green et al. (2007) conducted a study to examine teachers as coaches for students and found that coaching psychology had a positive impact on student engagement. Similarly, Madden et al. (2011) found that strengths-based coaching programmes increased student engagement and hope, and therefore may be considered a form of mental health prevention. Others have similarly found that coaching provides positive benefits for teachers regarding goal attainment, well-being, stress levels, resilience and daily practice (Grant et al., 2010; Lee, 2017; Lofthouse, 2019; Reinke et al., 2014).

Adams (2015) illustrates how coaching can be applied within the context of education. As detailed in Figure 4 below, the coaching process can be comprised of five stages:

Figure 4

Coaching structure, as illustrated by Adams (2016).

The second stage, also referred to as the contracting stage is said to be a defining element where the focus of coaching is agreed, goals are set and there is a clear vision and outcome between coach and coachee (Adams, 2016; Munro, 1999). During this stage, it is said that a “collaborative alliance” forms between the coach and the coachee (Bordin, 1979; Murphy & Duncan, 2007). Adams (2016) notes the importance of this stage for establishing rapport and building a relationship so that there is an environment whereby change can occur. Relationships are also important given that Murphy and Duncan (2007) suggest that 30% of the variance for the effectiveness of coaching comes from relationship factors between the coach and coachee. As such, it is recommended that the coach should possess good interpersonal skills, good listening skills and good observational skills to build this relationship (Munro, 1999).

As coaching progresses, sessions may include psychological approaches, such as solution-focused approaches and exception seeking (de Shazer, 1985, 1988; O’Connell, 2012). Research that has examined the working on what works (WOWW) approach suggests that exception seeking can improve the quality of education (Berg & Shilts, 2004). Fernie and Cubeddu (2016) used the WOWW approach in six sessions in a mainstream primary school class in Scotland in order to enhance classroom relationships and behaviour. The results indicate that the use of solution focused approaches such as WOWW within the classroom can improve teacher confidence, and help teachers to progress towards the specified goals regarding improving classroom relationships and behaviour.

Other psychological strategies which may be utilized within coaching sessions include ‘bridging’, a technique in which the coachee is encouraged to apply existing strengths and strategies to novel learning opportunities (Adams, 2016; Feuerstein et al., 1980). Throughout the coaching sessions, Adams (2015) highlights the importance of skills such as giving space, attentive listening, questioning, making suggestions, giving feedback and evaluating progress through the use of scaling techniques and questionnaires. The latter is considered particularly important for enabling the coachee to see themselves making progress, consolidate their learning in their long-term memory, and then automate their learning (Munro, 1999).

When coaching for development, it has been suggested that coaching sessions should follow a framework, such as GROW or I-GROW (Greene & Grant, 2003; Whitmore, 2002), PRACTICE (Palmer, 2007, 2008, 2011) or ACHIEVE (Dembkowski & Eldridge, 2003) in order to ensure that coaching is a structured and goal-directed conversation aiming to bring about change (Greene & Grant, 2003). Whilst each framework differs slightly, there are some similar principles including: identifying the current issue, identifying a SMART goal, thinking about what is happening presently, evaluating current options, and finally wrapping up the conversation and implementing actions. Alongside these frameworks, some also highlight the importance of the coach adopting a facilitative and dialogic approach to ensure equality in the relationship and the sharing of knowledge where appropriate to improve practice (van Nieuwerburgh et al., 2018).

Despite the increasing popularity and research within the wider field of coaching, there is still a relatively small amount of research examining the impact that coaching psychology can have in the context of education, including whether benefits are sustainable over time (Adams, 2016; Passmore & Theeboom, 2016; Wang, 2018). Examining whether coaching psychology can improve teachers' knowledge about working memory would therefore contribute to the novel and increasing evidence base in an emerging discipline.

2.9 Summary and Identification of a Gap in the Literature

To summarise, there has been a shift over the past seventy years regarding how memory is understood and conceptualized. There has been a shift from the perception of memory as distinct stores, to the belief that memory is formed of many components. This move towards a multi component model of working memory (Baddeley & Hitch, 1974; Baddeley, 2000) has led to an extensive body of research and literature exploring the application and importance of working memory in everyday life, including within education. The findings of this research have provided researchers and practitioners with an insight to the importance of working memory and how it can underpin children's learning, particularly with regards to literacy and mathematics.

The increasing body of research has also explored the development of working memory, suggesting that there may be a window for working memory to develop from pre-school until adolescence. During this time, it is also claimed that a shift takes place from visual working memory recall to verbal recall. Although it is unclear whether this window of time forms any cause and effect relationship, it is possible that students who struggle with this transition are at risk of finding education difficult. This is especially notable considering the links between working memory difficulties and special educational needs.

The research that has been conducted examining how working memory difficulties link with learning has led many to suggest that early identification and intervention is key. This has led to a rise in the development and subsequent evaluation of the many computer programmes that claim to train working memory ability, such as Cogmed (Cogmed, 2016), Jungle Memory (Memosyne Ltd., 2011) and Lucid Memory Booster (GL Assessment, 2017). Similarly, others have explored whether some assessments such as the Cognitive Profiling System can predict learning difficulties later in life (Marks & Burden, 2005). The consensus from the body of literature examining the effectiveness of such training programmes has been mixed, but largely indicates that any benefits observed are not transferable, and the designs of the programmes are critiqued for the emphasis they place on increasing storage and cognitive load, rather than other executive functions such as attention and processing. The belief by some that working memory is a trainable concept also adopts a medical model stance and implies that it is a “within-child” difficulty.

Contrary to this medical model stance, some research has considered working memory difficulties within the classroom and has attempted to increase teacher awareness and provide guidance on how to support students with difficulties. To date, however, this information has mainly been available to teachers via publications such as handbooks, and there has been very little research examining how this information is translated into teachers’ everyday pedagogic practice. It is therefore of interest to bridge this gap between empirical research knowledge and everyday application. One way to do this is via the use of coaching psychology techniques. Despite being a relatively novel sub-discipline, the research that has so far been conducted regarding the impact of coaching

within education is positive. Using coaching psychology techniques with teachers would not only facilitate the integration of research informed ideas into practice, but also contribute to the growing evidence base in the field. It is hoped that by working closely with teachers using a coaching model and enabling them to implement strategies within a reflective context, this will develop their teaching practices, understanding of working memory, and provide an alternative and practical way to support working memory rather than through conventional training programmes.

Chapter 3: Methodology

This chapter will outline the methodology and design of my research. I will begin by stating the aims and research questions for each phase of the research. I will then detail my philosophical assumptions, including my epistemology and ontology, before describing the procedure for each phase of my research.

My research design included three phases, and the data collection took place between May 2019 and April 2020. Each phase is described in more detail in this chapter (for a detailed timeline of my research, please see Appendix 1). A pilot study was not undertaken for this research as the coaching process meant that I was engaging in continual reflection and adaptation throughout.

3.1 Restating The Aims of This Research

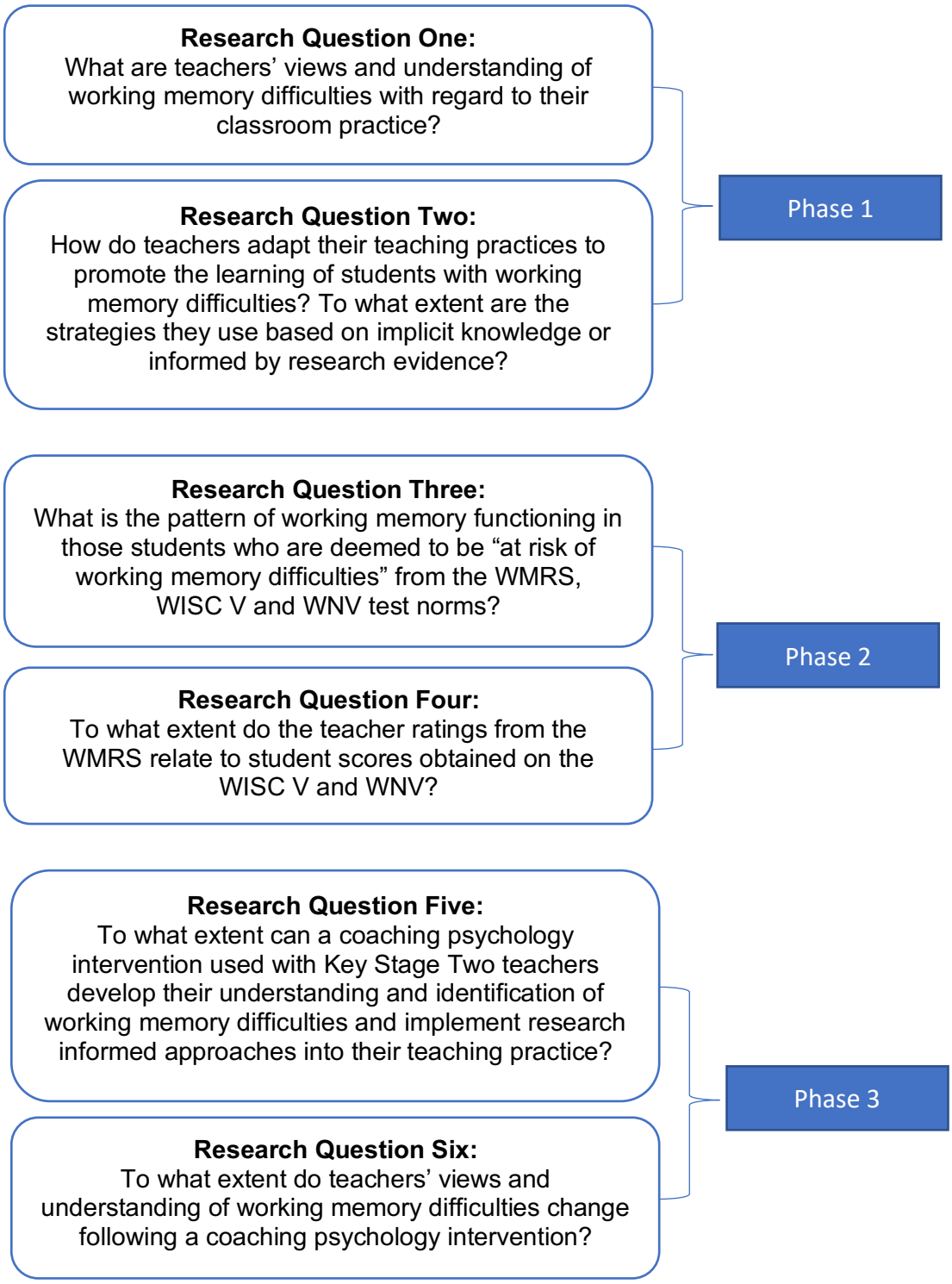
The aim of Phase One is to explore teachers' understanding of working memory and whether they adapt their teaching practices for students with working memory difficulties. For Phase Two, the aim is to identify students (for Phase Three) who may be 'at risk' of having working memory difficulties. For any students who are identified, the aim of Phase Three is to explore whether a coaching intervention can develop teachers' understanding of working memory, and implement research-informed approaches into their classroom teaching.

3.2 Research Questions

Following a review of the literature, I developed my research questions. They are based on the aims of the research and are depicted in Figure 5 below:

Figure 5

How my research questions link to each phase of my research



3.3 Philosophical and Theoretical Assumptions

When conducting research, many authors argue that the epistemological and philosophical underpinnings informing the choice of research questions, methodology, methods and intentions should be considered (Creswell, 2014; Grix, 2019; Mertens, 2010). Some suggest that these epistemological and philosophical considerations can be developed or adjusted throughout the research process, because the research questions may subsequently inform the design and methods (Crotty, 1998; Johnson & Onwuegbuzie, 2004). Others, however, advocate that assumptions should be specified at the beginning of the research as such assumptions may have implications for decisions made throughout the research process (Grix, 2019; Mertens, 2010). In other words, how one views the constructs of social reality and knowledge will likely affect one's decision making and evaluation of research. By specifying these assumptions before undertaking research, the researcher sets out their relationship between what they think can be researched (their ontological position), to what they imagine can be known about it (their epistemological position), and then how best to acquire this knowledge (their methodological approach). As such, I will set out my epistemological and ontological assumptions before engaging in the research.

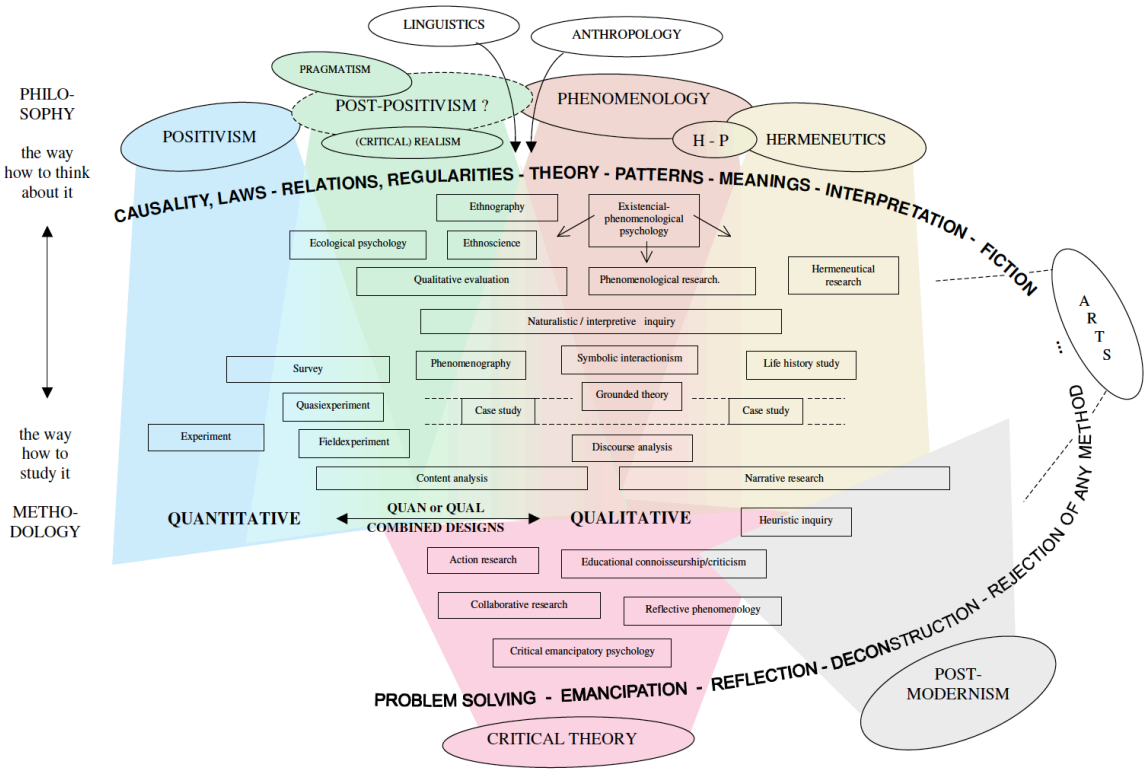
3.3.1 Various epistemological and philosophical stances

Niglas (2001; 2004) highlights the different paradigms encompassing the various epistemological and philosophical stances that one may hold (see Figure 6 for more detail). The classification of these paradigms is a source for debate within the literature. Some researchers choose to acknowledge six paradigms: constructivism, interpretivism, feminism, positivism, post-positivism and critical theory (Denzin and Lincoln, 2011). Others identify four paradigms: post-positivism, participatory/advocacy, social constructivism and pragmatism (Creswell, 2014). Given the research questions to be explored, this research will utilise a mixed-methods approach. The interviews in Phase One will use qualitative methods, while Phase Two and Phase Three will also incorporate quantitative approaches. As some argue, using a mixed-methods approach allows for a shift from a dichotomous view towards a continuum-based approach

with the strengths and weaknesses of both qualitative and quantitative research acknowledged (Giddings & Grant, 2006; Niglas, 2004; Onwuegbuzie & Leech, 2005; Patton, 2015; Tashakkori & Teddlie, 2010).

Figure 6

Various epistemological and philosophical stances, detailed by Niglas (2001).



3.3.2 Pragmatism and adopting a pragmatic approach

Some authors suggest that a mixed-methods approach is in line with pragmatic assumptions (Robson, 2011; Teddlie & Tashakkori, 2009), although the term "pragmatism" is debated within the literature. Some argue that it should be a paradigm (Ghiara, 2020), while others regard pragmatism not as a philosophical position or a paradigm, but as a method or a set of tools to address problems (Biesta, 2010; Briggs, 2019; Burke, 2013). Due to the ongoing debate, I will refer to my research as "sitting within a pragmatic approach" or "being in line with pragmatic assumptions" rather than claiming that my research adopts pragmatism as an ontological stance, epistemological stance or a paradigm.

Pragmatic assumptions emphasise action, intersubjectivity and understanding the world to guide our thinking, and consider future outcomes (Hassanli & Metcalfe, 2014). Briggs (2019) likens a pragmatic approach to Educational Psychology practice and argues that adopting a pragmatic approach provides an "alternative way of thinking about knowledge" (p.12). In other words, a pragmatic approach offers an alternative to traditional positivist or interpretivist paradigms and strives for methodological openness, and to bridge the gap between older structuralist approaches and newer naturalistic methods or approaches (Kaushik & Walsh, 2019; Patton, 2015). Therefore, the complexity and constraints of real-world research can be acknowledged, and the value of using different approaches recognised. A pragmatic approach would, therefore, fit with suggestions that methods and designs chosen for research should warrant the best fit for the research question being addressed (Giddings & Grant, 2006; Teddlie & Tashakkori, 2009).

Morgan (2014) and Briggs (2019) note, however, that some researchers operating within the field of mixed-methods research can be reductionist and may reduce the appeal of pragmatism to practicality, rather than considering its philosophical basis. As such, Morgan (2014) argues that when adopting a pragmatic approach, we need to draw on the work of Dewey (1929; 1938) who believed that our actions occur within changing social belief systems. One core element in the pragmatic approach advocated by Dewey (1929; 1938) is acknowledging that humans define the issues that matter. In other words, human actions cannot be separated from experience or beliefs (Kaushik & Walsh, 2019). In the context of this research, I previously worked with many school-age students who had difficulties with their working memory. This experience is likely to have informed my decision making and why I selected working memory over and above another topic.

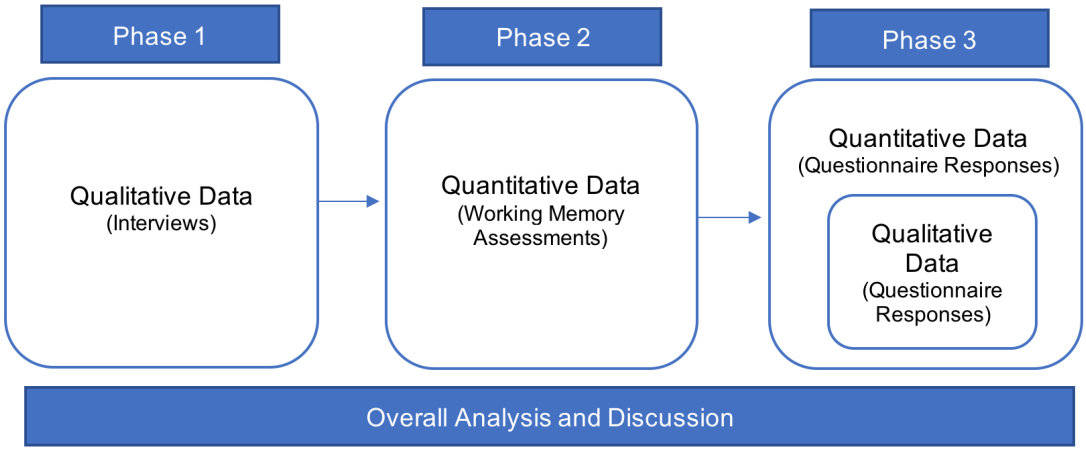
A second core element of Dewey's work is 'inquiry', described as the controlled transformation of a problematic situation into one where knowledge is sufficiently integrated (Ormerod, 2006). In other words, inquiry can help to address an identified socially situated problem (Kaushik & Walsh, 2019). Inquiry links with the aims of this research by using coaching to enhance teacher knowledge and bring about positive change. Morgan (2014) also advocates how pragmatic

approaches should focus on the nature of experience rather than reality. Given that the core values of coaching are collaboration, facilitation, being future-focused and being non-judgemental (Adams, 2016), adopting a pragmatic approach is key to ensure that the coaching focuses on the nature of individual experience.

A third element of pragmatism is 'abductive reasoning', described as the ability to move between induction (as in the qualitative data approach) and deduction (as in the quantitative data approach) based on reflections (Kaushik & Walsh, 2019). This flexibility of movement enables the researcher to inform decisions about practice and future outcomes without being tied to the constraints of one type of design (Hassanli & Metcalfe, 2014; Morgan, 2007). Exactly how this movement occurs depends upon the design used, for example, whether it is a sequential, concurrent or concurrent nested mix of designs (Creswell 2014; Tashakkori and Teddlie, 2010). In the context of this research, I will use thematic analysis to explore teachers' views and constructs about working memory, which will be a combination of deductive (analysed by interview question) and inductive (searching for overall themes). I will then explore whether certain recommendations or techniques from research literature can be applied in the classroom. As such, the research uses a sequential design, where qualitative and quantitative data is attributed equal status. Due to the optional nature of qualitative data items on the questionnaire however, Phase 3 adopts a concurrent nested design where qualitative data items complement quantitative data items (Giddings & Grant, 2006). This design is depicted in Figure 7:

Figure 7

The design of my research.



3.4 Phase 1 Method

The aim of Phase 1 was to explore teachers' understanding of working memory, and how they adapt their teaching practices for students who have working memory difficulties. Ten Key Stage Two teachers took part in 20-30 minute individual semi-structured interviews carried out between May 2019 and September 2019. This research was restricted to Key Stage Two (Years 3-6) due to some of the age limitations on the assessment measures used in Phase Two of my research.

3.4.1 Sampling and participants

Phase 1 took place within one local authority in a South East London borough. Convenience sampling techniques were used and school SENCos were notified about the research at a borough wide SENCo forum. Any schools who had Key Stage Two teachers who may be interested in taking part in the research were encouraged to contact me, and I sent an information sheet to SENCos explaining the purpose and process of the research (Appendix 2), along with a consent form for a member of the senior leadership team to sign (Appendix 3). Schools who returned consent forms signed by the senior leadership team were included in the study. This meant that a total of four mainstream primary schools and one primary additionally resourced provision (ARP) took part in the research. In two out of the five schools, I had previously established relationships with the SENCo through my work as a trainee educational psychologist (TEP).

After consent was obtained from a member of the school senior leadership team, I asked each SENCo to select children who they felt may have difficulty with their working memory. Twenty-one children across ten classes were identified as possibly experiencing working memory difficulties by the school SENCos. Table 3 summarises the demographics of the twenty-one identified students for their 2019-20 academic year groups:

Table 3

Demographics of students who were identified by school SENCos (N=21)

	Year 3 (n=3)	Year 4 (n=5)	Year 5 (n=3)	Year 6 (n=10)
Mainstream (boys)	1	1	1	3
Mainstream (girls)	2	2	0	5
Additionally Resourced Provision (boys)	0	1	2	0
Additionally Resourced Provision (girls)	0	1	0	2

Class teachers of these students were approached to take part in Phase One of the research and provided with an information sheet explaining the purpose and process of the research study and a consent form (Appendix 4). All teachers who were approached consented to take part, and returned a signed copy of the consent form to the researcher prior to interview. Table 4 summarises the gender demographics and Table 5 summarises the teaching experience of the ten teachers who took part in Phase One:

Table 4

Demographics of teachers who took part in Phase One (N=10)

	Female	Male
Mainstream	5	3
Additionally Resourced Provision	2	0

Table 5

Teaching experience of teachers who took part in Phase One (N=10)

Teacher	Number of Years Teaching	Age Groups They Have Taught
1	19	KS1 & KS2
2	15	KS1 & KS2
3	8	KS1 & KS2
4	4	KS2
5	7	KS1 & KS2
6	3	KS2
7	2	KS2
8	1	KS1 & KS2
9	6	KS2
10	7	KS1 & KS2

3.4.2 Development of the interview case studies

Participants were provided with two case studies to read prior to the interview. These case studies described two students, Nathan* and Maddie* (see Appendix 5) and were based on case studies detailed in Gathercole & Alloway (2007) and Gathercole et al. (2006). The aim of using case studies was to provide teachers with information regarding how a child with working memory difficulties may present in the classroom and encourage them to think of similar presenting students from their class.

3.4.3 Development of the interview schedule

A semi-structured interview design was used. Semi-structured interviews involve a list of pre-prepared topics or questions to be explored, but allow for deviation to enable a narrative as required. One advantage of semi-structured interviews is the ability to integrate principles of connectivity, humanness and empathy into the interview framework (Brown & Danaher, 2019). A second advantage of semi-

structured interviews is that they are, as Robson (2011) suggests, the best structure to use when the interviewer is also the researcher.

An interview schedule (Appendix 6) was developed for Phase One of the research with questions guided by the literature review. The questions were designed to be clear and not leading, as suggested by King and Horrocks (2010). The interview schedule consisted of six questions, including some open-ended questions designed to explore teachers' perception and understanding of working memory, and to explore whether teachers adapt their teaching practices for students with working memory difficulties. To ensure I did not impose my own constructs of working memory, the interview began by asking teachers to "think of a child who has difficulties with their learning." This allowed me to work from teachers' constructs and discuss working memory in a way that made sense to them. The interviews were conducted face-to-face between May 2019 and September 2019 and were recorded using a Dictaphone.

3.4.4 Phase one data analysis

All ten audio files were manually transcribed and interview transcripts were checked against voice recordings. During the transcription process, participants were given pseudonyms so that the data was anonymised.

The transcribed data was then analysed using a six stage reflexive thematic analysis framework (Braun & Clarke, 2006; 2013; 2019). Initially, only an inductive and data-driven approach was adopted to explore teachers' views and understanding of working memory. In this initial approach, themes were generated from across the entire data set, however this resulted in a very broad analysis. Following reflection, I decided to refine my analysis to make it more focused, so I re-coded and re-analysed the data using a combination of deductive (analysed by interview question) and inductive (searching for overall themes) methods. As such, I coded the interviews according to the following areas of interest:

- Classroom behaviours reported by teachers
- Whether difficulties were present across different tasks / lessons
- The teaching adaptations put in place
- Why teachers used these adaptations
- Whether adaptations had a positive impact
- Whether teachers received help from other professionals
- Whether teachers had previously heard the term working memory
- Teacher definition / description of working memory

Appendix 7 shows a sample of a coded interview transcript. Appendices 8 and 9 illustrate the process of developing themes from the initial codes. Table 6 outlines the six stage framework used to generate themes.

Table 6

The six-stage reflexive thematic analysis framework used to generate themes

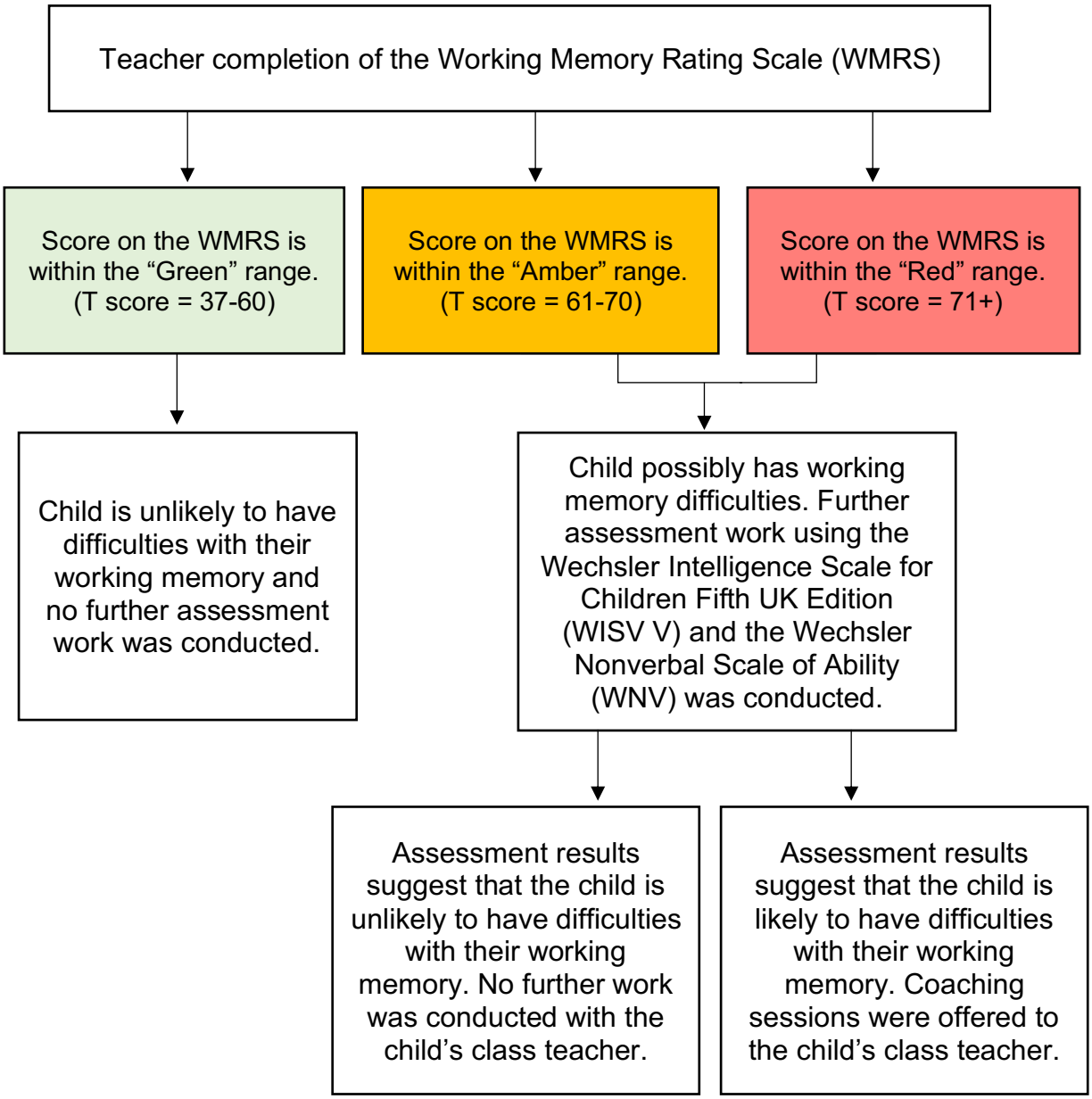
Phases of thematic analysis (Braun & Clarke, 2006, 2013)	**Description of process**
Phase one: Familiarisation with the data set	• Interviews were transcribed and transcripts checked against voice recordings • Transcripts were re-read • Initial notes of interest were made on transcripts
Phase two: Generating initial codes	• Initial codes were generated. As the interviews were conducted to answer two specific research questions, codes were initially generated in relation to the eight areas of interest identified above. Appendix 8 provides examples of these codes.
Phase three: Searching for themes	• The initial codes were then organized into several theme-piles to generate themes (see Appendix 9). Some codes were included in more than one theme.
Phase four: Reviewing themes	• Data extracts were cross-checked with coded themes to ensure they were coherent. • The entire data set was re-read to code any additional missed data and ensure that the themes fitted with the data set. • Following this review, some themes were discarded, some themes were collapsed into each other and others were adjusted. This resulted in the generation of three main themes and three subthemes (see thematic map in Appendix 10).
Phase five: Defining and naming themes	• Themes were named and a thematic map was created (see Appendix 10).
Phase six: Producing the report	• The themes were written in a narrative with supporting data extracts (see Chapter 4).

3.5 Phase Two Method

The aim of Phase Two was to identify students (for Phase Three) who may be at risk of having working memory difficulties. Phase Two consisted of a two-part identification process using the Working Memory Rating Scale (WMRS: Alloway et al., 2008), followed by standardised assessment if appropriate using the Wechsler Intelligence Scale for Children Fifth UK Edition (WISC V: Wechsler, 2016) and the Wechsler Nonverbal Scale of Ability (WNV: Wechsler & Naglieri, 2006). This process is depicted in Figure 8 below:

Figure 8

Two-part identification process to identify students who may be at risk of having working memory difficulties



3.5.1 Working Memory Rating Scale (WMRS)

The ten teachers who took part in Phase One completed the WMRS for students whom they or the school SENCo felt may have working memory difficulties. Children's names were kept confidential until parental consent was obtained (see Section 3.5.2).

The WMRS is a short 20 item behaviour rating measure designed for teachers to use to differentiate between children with low and average working memory abilities (see Appendix 11 for a completed copy). Alloway et al. (2008) detail how the scale is for children aged five to eleven, making it suitable for the Key Stage Two students in this research study.

On the WMRS, the teacher is asked to rate behaviour on a four point scale; Not Typical At All (0), Occasionally Seen (1), Fairly Typical (2) or Very Typical (3). The scores for each of the 20 items are then totalled, with a maximum score of 60. Higher scores are indicative of a greater degree of working memory difficulties. Scores are then converted into T-scores, although it should be noted that the T-scores for the WMRS are reversed in comparison to T-scores typically used on the WNV or WISC V. This means that higher T-scores are indicative of a greater degree of working memory difficulty. The T-score classifies students into one of three ranges; Green, Amber or Red (see Figure 8 above).

Alloway et al. (2008) recommend that children who score within the "Amber" range (one standard deviation above the mean) and children who score in the "Red" range (two standard deviations above the mean) undergo further follow up standardised working memory assessments. For this reason, they argue that the WMRS should be used a screening tool.

In total, the WMRS was completed for twenty-one students (N=21). Of these students, two scored in the "Green" range and nineteen scored within the "Amber" or "Red" range.

3.5.2 Follow up assessment using the WISC V and WNV

For the nineteen students who scored in the “Amber” or “Red” range on the WMRS, information sheets and a consent form were sent to parents (Appendix 12). If parents provided consent for their child to take part, follow up standardised assessment work was conducted with the student. Prior to carrying out this assessment work, students were discussed with the school SENCo to determine if there had been any previous EP involvement. Practice effects of standardised assessments are thought to be minimised after an interval of one to two years (McCaffrey et al., 2000), so it was agreed that any students who had received involvement within the past two years would not be included in the research. However, where there had been previous EP involvement, this was older than two years and was therefore not a cause for concern for practice effects.

As Baddeley (2010) suggests that working memory has two sensory modalities: an auditory modality (the phonological loop) and a visual-spatial modality (the visuo-spatial sketchpad), the follow up assessments aimed to assess each sensory modality. As such, seven subtests from the Wechsler Intelligence Scale for Children Fifth UK Edition (WISC V) and the Wechsler Nonverbal Scale of Ability (WNV) were administered to students. Full details of these subtests are listed overleaf in Table 7.

3.5.3 WISC V

The WISC V is an assessment measure for students aged 6-17, designed to assess cognitive ability. Specifically in regards to working memory, the original WISC (Wechsler, 1949) included two subtests to assess working memory: the Digit Span Forward and Digit Span Backward subtests. This remained unchanged until the fourth edition (WISC-IV; Wechsler, 2003) added Letter Number Sequencing as a new measure of working memory. The fifth edition (WISC V; Wechsler, 2016) then also introduced the Picture Span subtest to emphasise and assess visual working memory, and added the Digit Span Sequencing subtest. As described by Wechsler (2016), all WISC V working memory subtests use proactive inference. This means that competing pressures

Table 7

Subtests administered from the WISC V and WNV

	Subtest Name	Skills Assessed
WISC V	Digit Span Forward	• Auditory rehearsal and temporary auditory storage capacity (short-term auditory memory). • The child is required to listen to, and then repeat a sequence of digits that gradually increase in length.
	Digit Span Backward	• Auditory working memory. • The child is required to listen to a sequence of digits and then repeat these in reverse order. For example, if the child hears 9,4,6,8,2, they would be required to reverse this and state 2,8,6,4,9.
	Digit Span Sequencing	• Auditory working memory. • The child is required to listen to an increasing sequence of numbers and then repeat these in numerical order. For example, in this subtest, if the child hears 9,4,6,8,2, they should state 2,4,6,8,9.
	Letter Number Sequencing	• Auditory working memory. • This test is similar to the Digit Span Sequencing sub-test described above, but the child is required to listen to an increasing sequence of dual numbers and letters and then repeat these in both numerical and alphabetical order. For example, in this subtest, if the child hears 9,B,4,A, they should state 4,9,A,B.
	Picture Span	• Visual working memory. • The child is required to memorise pictures presented and then identify them in correct sequential order from a larger picture array where other 'distractor' pictures are present.
WNV	Spatial Span Forwards	• Short-term visual-spatial memory. • The child is required to watch and then copy a sequence of tapped blocks on a board. These sequences gradually increase in length.
	Spatial Span Backwards	• Visual-spatial working memory. • This sub-test is similar to the Spatial Span Forwards subtest described above, but the child is required to watch a sequence of tapped blocks on a board and then repeat these in reverse order.

are placed on cognitive processing because previously seen items may interfere with the present memory. For example, in the Picture Span subtest, 'distractor' pictures are present, and these pictures may have already been seen in previous trials. Five subtests were used from the WISC V: Digit Span Forward, Digit Span Backward, Digit Span Sequencing, Letter Number Sequencing and Picture Span. Table 8 illustrates how these subtests load onto each index score.

Table 8

Subtests required to calculate the WISC V index scores

WISC V Working Memory Primary Index (WMI)	WISC V Auditory Working Memory Ancillary Index (AWMI)
• Digit Span Forward	• Digit Span Forward
• Digit Span Backward	• Digit Span Backward
• Digit Span Sequencing	• Digit Span Sequencing
• Picture Span	• Letter-Number Sequencing

It should be noted that out of the nineteen students in the sample, eight students did not complete the Letter-Number Sequencing subtest due to a range of factors including refusal, fatigue or a lack of understanding of the task requirements. As this subtest is required to calculate the Auditory Working Memory Index, this index score could not be obtained for these students.

For each of the individual subtests, scaled scores were calculated from raw scores. The Working Memory Index (WMI) and Auditory Working Memory Index (AWMI) were then derived from the sum of the required scaled scores, to provide a composite score and percentile for each index. Further analyses were then conducted to assess whether there were any statistically significant differences on pairwise comparisons between the indexes or between individual subtests. Analyses also explored base rates for the Longest Digit Span, Longest Picture Span and Longest Letter-Number Sequence. It should be noted that because only the WMI and AWMI indexes were of interest to this research, a Full Scale IQ score (FSIQ) was not calculated.

3.5.4 WNV

The WNV was originally designed to minimise the need for expressive and receptive language skills. As Naglieri (2003) states, the term non-verbal refers to the content of the test, not the ability. In addition, the pictorial directions supplementing subtest administration enhance test accessibility for students from diverse cultures or those with additional learning needs.

Two subtests were used from the WNV: Spatial Span Forwards (SSpF) and Spatial Span Backwards (SSpB). These subtests were adapted for the WNV from the Wechsler Memory Scale-Third Edition (WMS-III; Wechsler, 1997b), and are argued to be a good measure of general ability and involve working memory with visual-spatial stimuli (Wechsler & Naglieri, 2006). The SSpF and SSpB subtests are suitable for students aged eight to twenty-one. Three students were unable to complete the WNV assessment because the norms of the assessment begin at 8 years, 0 months and their chronological age fell below this (7 years, 3 months – 7 years, 4 months).

For each of the SSpF and SSpB subtests, a raw score and T score was calculated. The total raw score from both subtests was then used to calculate an overall Spatial Span T Score and corresponding age equivalent. It should be noted that because only the Spatial Span subtests were of interest to this research, a full scale score (to assess IQ) was not calculated. Optional further analyses were also conducted to assess whether there were any statistically significant differences between the SSpF and SSpB, and to explore base rates for the Longest Spatial Span Forward (LSSpF) and Longest Spatial Span Backward (LSSpB) data.

3.5.5 Scoring and report dissemination

I scored the WISC V and WNV by hand using the relevant Administration and Scoring Manuals. Where possible, I double checked my scoring using the Pearson Q Global online scoring system. A short report was written for each of the nineteen students (see Appendix 13 for an anonymised copy of one report). These reports were countersigned by one of my university research supervisors

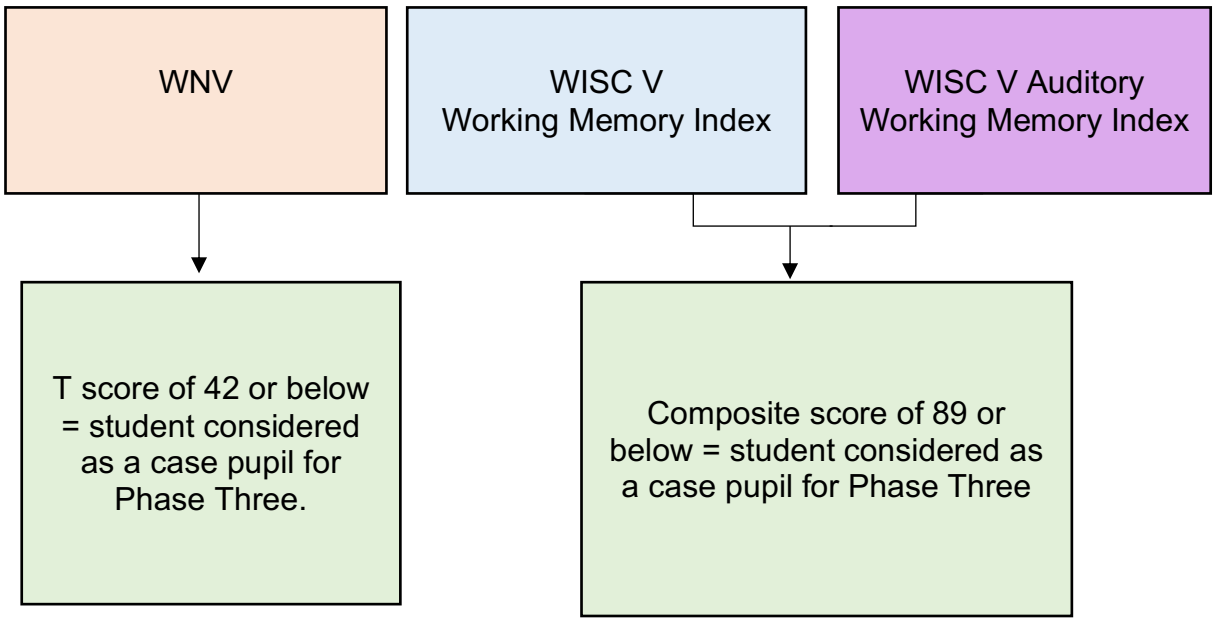
and sent to schools, who were asked to also distribute a copy to that child's parents.

3.5.6 Inclusion criteria for phase three

Students were considered to have difficulties with their working memory and therefore eligible to be case pupils in the research if they scored in the "Low Average" range or below on at least one of three indexes (see Figure 9). For the WISC V Working Memory Index and WISC V Auditory Working Memory Index, those with a composite score of 89 or below fell in the "Low Average" range. For the WNV, those with a T score of 42 or below on the Spatial Span subtest fell in the "Low Average" range.

Figure 9

Inclusion criteria to determine students who have difficulties with their working memory and who are therefore eligible to be case pupils in Phase Three of the research



A total of twelve students (N=12) across seven classes scored in the "Low Average" range, and their corresponding class teachers were invited to take part in a series of coaching sessions (Phase Three of the research). Table 9

summarises the demographics of the twelve identified students for their 2019-20 academic year groups:

Table 9

Demographics of students who were eligible to be case pupils (N=12)

	Year 3 (n=0)	Year 4 (n=4)	Year 5 (n=3)	Year 6 (n=5)
Mainstream (boys)	0	1	1	0
Mainstream (girls)	0	1	0	3
Additionally Resourced Provision (boys)	0	1	2	0
Additionally Resourced Provision (girls)	0	1	0	2

3.5.7 Phase Two Data Analysis

Each student's WMRS, WISC V and WNV data was manually input into the Statistical Package for the Social Sciences (SPSS) computer programme. To explore the pattern of working memory functioning, I calculated descriptive and frequency statistics for the WMRS rating measure, WISC V and WNV assessment measures.

To then explore the relationship between the teacher ratings from the WMRS and the student scores obtained on the WISC V and WNV, I conducted a series of correlational analyses using SPSS. Although the variables were continuous and consisted of interval data (T-scores), the sample size was relatively small (N=19) so Spearman's Rho correlations were conducted. One tailed tests were used because it was predicted that where students were identified with possible working memory difficulties by their teachers using the WMRS, they would be likely to score lower on the WISC V and WNV assessment measures. Further Spearman's Rho correlational analyses were also conducted to explore the relationship between the T-scores on the WMI, AWMI and WNV. See Appendix 14 for SPSS outputs.

3.6 Phase Three Method

The aim of Phase Three was to explore whether a coaching intervention could be used with Key Stage Two teachers to develop their understanding of working memory, and implement research-informed approaches into their teaching.

3.6.1 Participant sample

All seven teachers who were approached in Phase Two agreed to take part in the coaching. Table 10 summarises the demographics of the teachers who took part:

Table 10

Demographics of teachers who took part in Phase Three (N=7)

	Female (N=5)	**Male (N=2)**
Mainstream	3	2
Additionally Resourced Provision	2	0

3.6.2 Coaching structure

I attended a one day training course on 25th January 2019 titled “Using coaching to develop classroom practice” led by Mark Adams, Educational and Coaching Psychologist. Following this training course, I provided each teacher with a series of three to four individual coaching sessions. Table 11 illustrates how these coaching sessions were broken down for each school, and Figure 10 illustrates the coaching process:

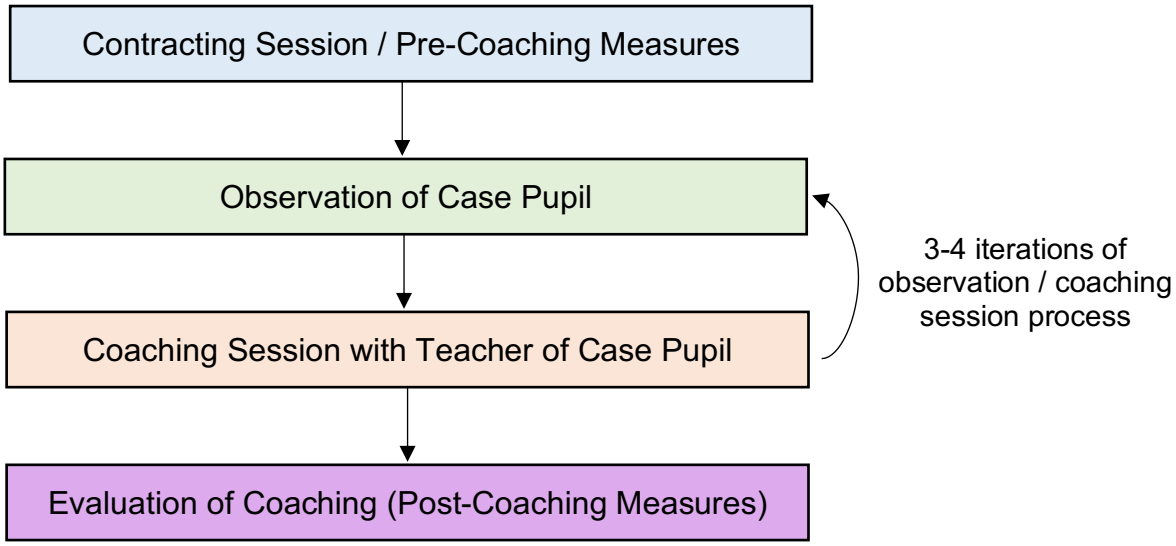
Table 11

Coaching session structure for each school

School	Teacher	Number of Coaching Sessions	Coaching Undertaken
1	1	3 + 1 review session	June 2019 – July 2019
2	2	3 + 1 review session	October 2019 – December 2019
3	3	3 + 1 review session	October 2019 – December 2019
4	4	3 + 1 review session	October 2019 – November 2019
	5	3 + 1 review session	October 2019 – November 2019
5	6	3 + 1 review session	October 2019 – December 2019
	7	4 + 1 review session	September 2019 – December 2019

Figure 10

Example of coaching process



3.6.3 Contracting session and pre-coaching measure

For all teachers, a coaching contracting session was held prior to the first coaching session. Adams (2016) argues that contracting sessions are key to building the collaborative alliance. This is done by ensuring that the focus and goals of coaching are mutually agreed, roles and ways of working are clarified and confidentiality parameters are established. All coaching contracting sessions in this research were conducted with myself and the coachee, although Adams (2016) notes that it can sometimes be helpful to have other stakeholders present at this session.

During the coaching contracting session, I asked each teacher for their hopes and goals from the coaching. Using this information, I developed a mind-map (see Appendix 15) to help link coachee goals with the research literature. This mind-map depicted the coachee goals, alongside recommended strategies for working memory difficulties obtained from Gathercole and Alloway (2007) and my literature review in Chapter Two. This mind-map was referred back to periodically throughout the coaching and strategies or ideas were added as appropriate.

Given the links between coaching and self-efficacy (de Haan et al., 2016; Franklin & Doran, 2009; Lee et al., 2013; Moen & Allgood, 2009), I asked each coachee to complete a pre-coaching self-efficacy measure at the end of the coaching contracting session (see Appendix 16). This measure required each coachee to rate their degree of confidence for four statements on a scale between 0 (I cannot do) to 100 (highly certain I can do).

3.6.4 Coaching observation

Prior to each coaching session, I carried out an informal and non-judgemental lesson observation, examining the response of the child to teacher instructions and teaching adaptations. For example, the observations often concentrated on how that student coped within the classroom environment, alongside any strategies used to support that student and the impact these had. The focus of this observation was always on the case pupil rather than the teacher, as the purpose was to allow teachers to actively reflect on their practice (Adams, 2015).

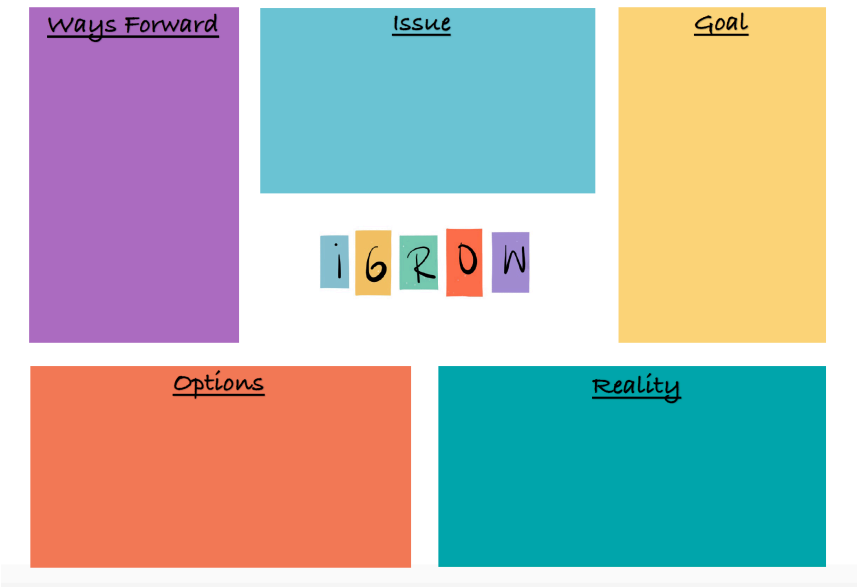
Observation notes were recorded in a transcript style and will hence forth be referred to as “observation transcripts”, as detailed by Adams (2015). These observation transcripts were factual and often recorded speech or interactions verbatim to ensure that the observation was not perceived as judgemental by the coachee. For an example of the observation transcript used, see Appendix 17. At the beginning of each coaching session, the coachee read through the observation transcript for a few minutes and this often initiated discussions about the particular student. A photocopy of the observation transcript was taken so that the coachee could keep and refer back to the notes between sessions if needed, whilst also ensuring I had a copy for my own records.

3.6.5 Coaching framework

The I-GROW model (Greene & Grant, 2003) was used throughout the coaching sessions to provide structure, an overarching framework, and capture the discussion (see Figure 11). Adams (2016) argues that using a structure in coaching can be beneficial as it can guide questioning, aid reflection, provide direction and ultimately be shared with the coachee. I jointly completed the I-GROW framework with each coachee by hand during each coaching session. A photocopy was taken so that the coachee could keep and refer back to the framework between sessions as required, whilst also ensuring I maintained a copy for my records.

Figure 11

Copy of the I-GROW framework used within the coaching sessions

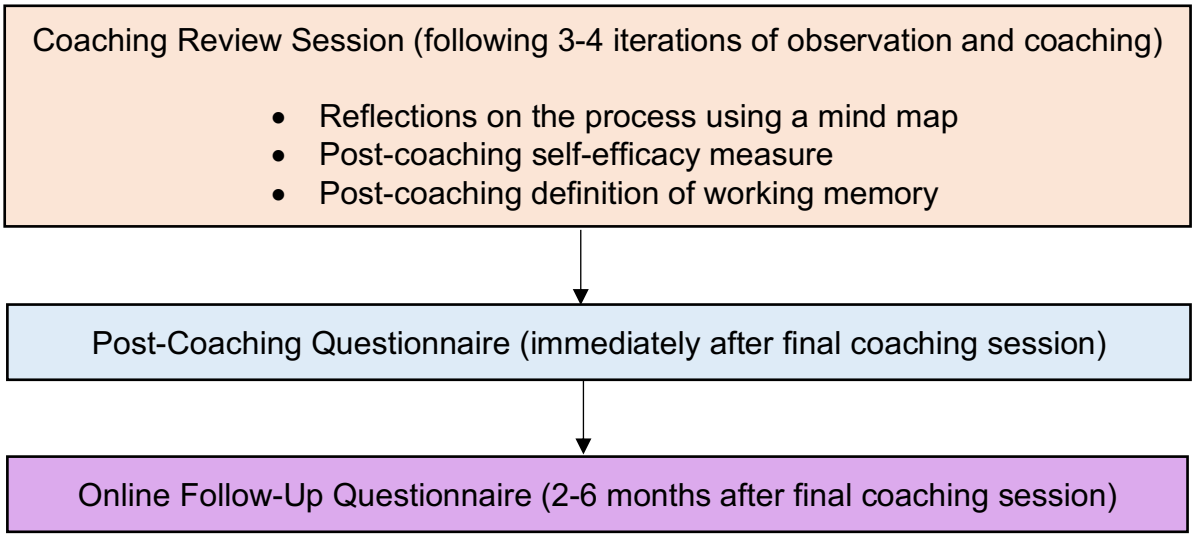


3.7 Methods to Evaluate Coaching

The process to evaluate the coaching intervention is illustrated below in Figure 12:

Figure 12

Coaching evaluation process



3.7.1 Coaching review session

Following a cycle of three to four observations and coaching sessions, a final review session was held between the coach and coachee. In some cases, stakeholders were also present such as the school SENCo. The review session was an opportunity to review goals and the coaching process. Prior to the review session, I (the coach) created a mind-map summary for each coachee to aid dialogue and reflections on the entire research process. This included themes from interviews, information from the individual assessment work, themes from the coaching and the set goals with any noted progress. See Appendix 18 for an example of this mind map.

During the review meeting, coachees completed a self-efficacy measure (identical to the pre-coaching measure, see Appendix 16). Pre and post-coaching measures were compared and any change in scores were discussed with the coachee. In addition to the self-efficacy measure, participants were asked one qualitative question which was recorded on a Dictaphone: “can you describe what

you think the term *working memory* means in a few sentences?" Responses from this qualitative question were compared with the initial interview responses to explore whether the coaching intervention had changed teachers' understanding of working memory.

3.7.2 Post-coaching questionnaire

Following the coaching review session, each coachee completed a post-coaching questionnaire (Appendix 19). This questionnaire consisted of five sections which are detailed in Table 12:

Table 12

Post-coaching questionnaire format

Questionnaire Part	Designed to Evaluate	Response Options
1	How well the coach and coachee worked together	6 point Likert scale with the option to also include a qualitative open-ended response
2	The impact of the coaching	Yes / No / Not Applicable options with the option to also include a qualitative open-ended response
3	Changes in teacher understanding of working memory and changes in teaching practices for those with working memory difficulties	5 point Likert scale, with the option to also include a qualitative open-ended response
4	Whether coaching would be recommended to others	Yes / No / Unsure options with the option to also include a qualitative open-ended response
5	Changes made within the classroom as a result of the coaching	Qualitative open-ended response

Responses from all sections of the questionnaire (except the qualitative open-ended responses) were scored numerically. The data was manually input into SPSS and analysed using descriptive statistics.

3.7.3 Online follow up questionnaire

Between two and six months after the final coaching session, a short online follow up questionnaire was distributed to all coachees to explore the longer-term outcomes and effects of the coaching. The questionnaire consisted of seven short questions and was distributed by my local authority placement supervisor so that participants felt able to answer freely. The format of this online follow-up questionnaire is detailed in Table 13. Please refer to Appendix 20 for a blank copy of the online questionnaire.

Table 13

Online follow-up questionnaire format

Question Number	Designed to Explore	Response Options
1	Whether coaching had a positive impact on personal and professional development	3 point Likert scale (No / A Little / A Lot)
2	Whether coaching discussions are still relevant to teaching practices	Yes / No with the option to also include a brief qualitative open-ended response
3	Whether any knowledge from the coaching is used in current teaching	Yes / No with the option to also include a brief qualitative open-ended response
4	Whether coaching knowledge has been shared with other colleagues	Yes / No with the option to also include a brief qualitative open-ended response
5	Whether teachers feel confident to identify other students who may have working memory difficulties.	Yes / No
6	Whether teachers would recommend coaching to other colleagues	Yes / No
7	Whether teachers had any further comments or reflections on taking part in the research	Qualitative open-ended response

Out of the seven teachers, five responded to the online follow-up questionnaire (n=5). Responses from all sections of the questionnaire (except the qualitative

open-ended responses) were scored numerically. The data was manually input into SPSS and analysed using descriptive statistics.

3.8 Ethical Considerations

Ethical approval was received on 18th April 2019 from the University of Exeter ethics committee (see Appendix 21 for a copy of the certificate of ethical approval). Table 14 details how participants provided their consent according to each phase of the research:

Table 14

Consent for each phase of the research

Phase	How Consent Was Provided
1 (Teacher Interviews)	• Signed consent form completed by a member of the senior leadership team to work with the school. • Signed consent form completed by teachers (N=10) taking part in the interviews.
2 (Pupil Assessment)	• Signed consent form completed by parent / carer of child (N=21) to take part in the research. • Verbal consent from students to undertake assessment work.
3 (Coaching)	• Signed consent form completed by teachers (same as Phase 1) • Verbal consent to undertake coaching.

All participants were informed about the nature of the research study via the information sheet (Appendices 2, 3, 4 & 12). This information sheet included a clear explanation of the nature of the study, why the research was being conducted, what taking part in the research would involve, how participant data would be stored and used, information regarding data protection procedures and contact details for myself. Participants were asked to read the information sheet before signing the consent form, which also explained the voluntary nature of

participation and that they had the right to withdraw from the research study at any time. A hard copy of each consent form was kept by myself, the researcher. In Phase 1, no identifying information was collected. Information such as roles and years of experience were collected but the interviews did not require the participants to give their own name, a child's name nor the name of the school where the research was taking place. Once transcribed, participants were given pseudonyms.

In Phase 2, school staff were asked to keep children's names confidential until parental consent was obtained. The standardised assessment data from the WISC V and WNV was held confidentially by myself. Each school's results were kept on a password protected computer and only made available to that class teacher undertaking the coaching and the school SENCo. Reports for school staff and parents / carers were written for each child who completed the follow-up WISC V and WNV standardised assessments. These reports were also saved on a password protected computer and only made available to the school SENCo, class teacher and parent / carer of that child. If the child's parents or school staff had any concerns following receipt of the report, they were provided with my contact details and given the opportunity to contact me.

In Phase 3, the case pupils (identified from Phase 2) were verbally discussed and any written information from the coaching sessions was left at the school with the class teacher. Any case study notes that were later recorded by myself used pseudonyms for the child, class teacher and school to ensure confidentiality. The researcher was aware of who completed the post-coaching questionnaire due to the nature of how it was returned i.e. via email or handed to me in person.

This chapter has stated the aims of the research, research questions, theoretical assumptions, methods for each phase of the research and the ethical considerations. Chapter Four will present the findings from Phase One of my research.

Chapter 4 : Findings From Phase One

Phase One involved ten semi-structured interviews with Key Stage Two teachers. This chapter will examine the findings from this phase in two parts.

Part One will consider teachers' views and understanding of working memory difficulties. This will be illustrated by examining teacher definitions of working memory in comparison to the current research based concept of working memory from the literature. Following this, I will examine how teachers perceive a student who has possible working memory difficulties in their classroom. I will detail this on an individual teacher basis before using thematic analysis in a deductive manner to examine the themes across all cases.

Part Two will consider how teachers adapt their teaching practices to promote the learning of students with working memory difficulties, and whether adaptations are based on implicit knowledge or informed by research evidence. I will consider this first on an individual teacher basis, followed by using thematic analysis in a deductive manner to examine themes across all cases.

Together, both parts will address research questions one and two:

Research Question One: What are teachers' views and understanding of working memory difficulties with regard to their classroom practice?

Research Question Two: How do teachers adapt their teaching practices to promote the learning of students with working memory difficulties? To what extent are the strategies they use based on implicit knowledge or informed by research evidence?

4.1 Teachers' Definitions of Working Memory

In order to examine teacher views and understanding without applying my own constructions of working memory, I considered how teachers' understanding of working memory fitted with the current research based concept of working memory from the literature. As such, I mapped the ten teachers' understanding onto the definition provided by Gathercole and Alloway (2004) who define working memory as "the ability to hold and manipulate information in the mind for a short period of time" (p.2) Table 15 provides a summary of the ten teachers' understanding, with further detail below. Please note that throughout this thesis, any page and line numbers displayed in brackets after quotations refer to the corresponding interview transcripts.

Table 15

Teachers' understanding of working memory in relation to the current research based concept of working memory from the literature.

	Definition was unconnected to the current research based concept of working memory	**Definition was slightly connected to the current research based concept of working memory**	**Definition was closely connected to the current research based concept of working memory**
Teacher had not heard about working memory	Rachel Gemma	Jo Jack Caroline	
Teacher had heard about working memory	Matthew Jamie	Zoe	Victoria Chrissie

When asked "have you ever heard about working memory?", five teachers stated that they either had not heard of working memory or had limited knowledge of the term. When they were then asked "can you describe what you think the term working memory means?", two teachers (Rachel and Gemma) provided a definition unconnected to the current research based concept of working

memory. For example, Gemma explained how she had not heard about working memory and perceived it as:

> based on sociology and different parts of the mind and different people working in different ways... So some people are kinaesthetic learners, some people are visual learners and it is how they best retain the information. So some people retain it just from viewing it, some people have to see it to retain it, some people have to do it to retain it (page 7, line 215).

Rachel's constructs of working memory were also unconnected to the current research based concept of working memory. She stated how "working memory is something I don't really know much or have thought much about I guess" (page 3, line 67) and explained:

> my son is severely dyslexic, so I'm also thinking well his working memory is probably quite poor because erm his organisation is all over the place and also day-to-day writing or reading he just can't remember how to put the things in (page 10, line 313).

Rachel also detailed how she believed that working memory could be improved by "repeating things over and over and over. And using visuals to trigger or even smells" (page 13, line 409). These extracts from Rachel and Gemma are therefore unconnected to Gathercole and Alloway's (2004) definition concerning holding and manipulating information in mind.

Three other teachers, Jo, Jack and Caroline, stated that they had not heard about or had no knowledge of working memory, but their definitions were slightly connected to the concept of working memory provided by Gathercole and Alloway (2004). When asked to describe working memory, Jo's definition makes reference to holding and manipulating information:

> the memory in the present working when it is taking in information through any of the senses and it is being erm applied to whichever part of the brain it needs to go to. Something like that? (laughs). Yeah I imagine any instant intake of

> information before it gets put into the part of the brain it needs to go to (page 6, line 171).

Jo also detailed an everyday task that would require students to hold information in mind for a short period of time and would therefore draw on working memory: "following instructions, a list of instructions. Being able to take them all in and then be able to independently carry those instructions out on their own….they [the students] need to use their working memory for that" (page 6, line 189).

Jack also explained that he had not heard of working memory through training opportunities: "being honest, I would not have much knowledge of working memory at all. Erm not even three years at uni doing primary ed, I didn't come across it I don't think much" (page 4, line 127). When asked how he may define working memory however, he stated "I would assume it is something to do with the task they are being told about, whether they can remember each instruction for tasks" (page 5, line 150). He explained "if you are told instructions, you could be given ten points for one part of an instruction and you would only be able to remember a certain amount really" (page 6, line 184). As such, Jack's definition illustrates how a task such as remembering instructions requires students to hold and manipulate information in their minds.

Caroline also stated "I don't think I have ever heard about it being referred to as working memory" (page 9, line 297), but then provided the analogy of a shelf. She detailed how "if you give someone too much, whatever you do at the beginning drops off" (page 9, line 300). Caroline also detailed an example of when working memory may be required in the classroom:

> if you are writing, can you remember that you need capital letters, full stops. Can you remember how to spell a set of words? So they are the kind of things that you have already learnt, skills that you need to reuse and can you remember how to do it but then also can you remember what is required of you (page 10, line 328).

Similarly to Jo and Jack, Caroline had stated how she had not heard of working memory, but her construct was then slightly in line with that outlined by

Gathercole and Alloway (2004). In this case, punctuation and sentence structure illustrate how students have to hold or process information.

The other five teachers stated that they had heard about working memory, although their familiarity with the term varied. Two teachers provided definitions which suggested that their constructs of working memory were unconnected to that provided by Gathercole and Alloway (2004). Matthew stated how he had "heard about it" (page 4, line 117) from the SENCo and in-school discussions but then explained how he perceived working memory as "the ability to sort of retain information over a medium to long period of time…and be able to recall what they [the students] need to use" (page 5, line 142). As such, Matthew's construct was centred around retention and applying learnt knowledge to tasks.

Similarly, Jamie stated that he had heard about working memory "when I was doing my teacher training and when we often have conversations [between staff at school]" (page 7, line 221). His construct of working memory, however, was focused on the ability to process prior knowledge, which was not in line with the current research based concept. Jamie explains:

> I would see it as that ability to take up on something that is not necessarily a new experience but take up on something that has been supplied to them and then process that and use that in whatever way they need to do (page 9, line 270).

One teacher, Zoe, was more familiar with the term. She stated that she had "heard a little bit about the working memory research" (page 4, line 131) through following "people who write articles in journals or in magazines" (page 6, line 183) using the social media platform Twitter. She explained how she construed working memory as "like the day to day memory. More like your short-term memory because it is the things you are using as you are going along rather than things you have to draw on from ages ago" (page 6, line 193). Zoe's definition and construction of working memory as a processor and 'day to day memory' has ties with the concept of holding and manipulating information provided by Gathercole and Alloway (2004).

Two teachers, Victoria and Chrissie, provided definitions that were closely linked to the research based concept provided by Gathercole and Alloway (2004). Victoria stated she had heard the term a few times from staff training in a previous school and construed working memory as "your ability to kind of remember what tasks you are given in order to continue working on the task you are doing. So it is kind of just that day-to-day memory for holding instructions and processing them I guess" (page 8, line 242). The notion that working memory is important for 'holding instructions and processing them' strongly links to Gathercole and Alloway's (2004) definition of holding and manipulating information in mind for a short period of time.

Chrissie also stated that she had heard the term previously through SEN training and discussions with colleagues about individual student needs. Similarly to Victoria, Chrissie's definition was in line with that given by Gathercole and Alloway (2004) as she explained how she perceived working memory as:

> remembering a series of key details to be able to put into their learning… So one thing they might be able to remember. But when you say this and this and this, that's too much. They [the students] can't do that (page 7, line 202).

In addition, Chrissie stated how she perceived working memory as "one of those buzzwords that sometimes you hear" (page 5, line 168) and noted how her previous training and knowledge is not used "necessarily as much as I would like" (page 6, line 180). This therefore illustrates how working memory can sometimes be regarded as a 'buzzword' and how knowledge about the term does not always translate into practice, possibly due to wider constraints or pressures.

In summary, the results of this analysis suggest that out of the ten teachers interviewed, only half stated that they had previously heard of the term working memory. Of these five teachers, only three were then able to describe working memory in a way that was connected with the current research based concept of working memory defined by Gathercole and Alloway (2004). This suggests that few teachers had an accurate understanding of working memory and some had misconceptions about the term.

4.2 Teacher by Teacher Classroom Presentation

Appendix 22 provides a summary of all ten teachers' reported observations of behaviour for students who have difficulties with their learning (and therefore may have working memory difficulties). Due to space constraints however, this chapter will explore the classroom presentation in detail for the seven teachers who undertook coaching.

Rachel

When asked to think about a child who struggles with learning (and may therefore have working memory difficulties), Rachel commented that the child who came to mind "often gets very distracted" (page 3, line 87). The implications of this distraction on completing everyday classroom tasks was illustrated:

> she will start writing words, she will write one word and last year when I started with her she would then have a word down there at the bottom of the page and the next word might be wherever on the page (page 3, line 88).

In addition to difficulties with attention and focus, Rachel also noted how this particular child struggles to process spoken information. Her comment 'it's important to give her that time' highlights how Rachel recognises and adapts her teaching for this difficulty:

> she just has maybe a slower processing speed in terms of her speech. So you might ask her a direct question and she then might spend a few moments thinking through her answer. It's important to give her that time rather than always giving her prompts (page 5, line 153).

Retaining and applying learnt information to tasks was another area of difficulty for this particular child. Rachel commented how the student "finds it tricky transferring the phonics she has done to the writing" (page 6, line 177) and highlighted her struggles with longer term retention: "say you have been doing measure, or shape and space for a week or two and then come back to number,

then she will always struggle on reversing the numbers or just remembering" (page 5, line 137).

These difficulties with focus, processing, retention and generalising learnt skills were observed across the curriculum and impacted on wide range of areas including organisational skills:

> the first child I spoke about, organisationally she is back and forth. So in terms of bringing equipment to school she has obviously forgotten or got in a muddle. Or even if we have a pile of things she needs to take home, and she will just take someone else's pile because she has forgotten it's her pile you know (page 5, line 145).

Gemma

Gemma, a teacher who works within a SEN provision, commented how classroom activities place demands on memory. For example, "setting up their visual timetables so they know what comes next" (page 9, line 293) or "the TEACHH activities…they have to have the knowledge of constructing a sentence or the knowledge of moving something, or again sometimes the physical skills of cutting, sticking.. I think the TEACHH activities probably use their memory quite a bit" (page 8, line 255). These extracts highlights how multi-modal resources such as visual timetables used in specialist classroom environments can also place demands on memory. Gemma also noted the day-to-day retention demands placed upon students:

> they have to hold onto the previous day's work because it feeds into their development each day and through the week in the foundation topics. Again with things like behavioural expectations, they hold onto those expectations and how they should behave (page 9, line 296).

Gemma noted how the student she was thinking of might be "sat there looking as though he is listening but maybe quite spaced out, probably isn't listening as such…he is probably not even taking in anything" (page 2, line 58). Her comment

indicates the masking behaviours exhibited by ‘looking as though he is listening.’ In addition, Gemma noted that this particular student “would just be waiting, waiting for help” (page 3, line 82) and “when they go to tabletop work, he will sit there” (page 4, line 115). Such comments therefore illustrate that the student is often passive and willing to accept adult support.

Although Gemma noted that such difficulties were apparent across curriculum tasks, creative tasks appeared to be a strength for this particular student. Gemma explained that in Art, “he will start independently and work fully independently. He is amazing at Art and that is something that really interests him” (page 3, line 87).

Zoe

Zoe noted that the child who came to mind would be “looking like they are daydreaming, not following all of the instructions, even if I have only given one instruction it is just kind of processing that” (page 2, line 38). She notes:

> I try and only give one instruction at a time but sometimes it is “okay finish the sentence you are on and then put your book away” and they are like “what do you mean?”…so it is a lot of that processing of information and them not completing the things that have been said (page 2, line 41).

Her extract highlights the processing difficulties experienced by the student, particularly for multiple pieces of information. This results in students presenting as passive learners within the classroom or unable to complete tasks. Zoe explains that when students experience processing difficulties within the classroom, they “would probably pause, and kind of know that I have said something, but then be sitting there going ‘oh what did she say?’ and you can see it ticking away” (page 2, line 51). At other times, Zoe notes that the student may engage in avoidance behaviours and be “sitting there tapping or something than actually doing [their work]” (page 2, line 55). These examples illustrate a notion that students are lost in their learning and may engage in subsequent activities to detract from being unable to complete the task.

Zoe stated that such behaviours were observed “probably more so in the more academic subjects, the ones where they have got to do the most work and I think they know that is the ones where they have to sit and focus for the longest time” (page 2, line 65). This therefore illustrates how difficulties are exacerbated by workload and tasks which place demands on student attention.

Chrissie

Chrissie detailed how a few students came to mind who were “well-behaved, quiet, doing the right thing” (page 3, line 83), but struggled to focus or remember details. She notes how cognitive load in particular can impact on students memory:

> I think in the way we do our English, they have like a series of top ticks that they need to get into each piece of work. And I think that is something where they might think, well I can do each of these things discreetly. But when you say, now can you use relative clauses, fronted adverbials, complex sentences and modal verbs together, it’s something that now remembering how to do any of one of those things is too much (page 8, line 239).

Chrissie also highlights the emotional impact of such struggles. Her mention of students getting ‘really upset’ with their learning indicates how memory difficulties can impact self-esteem and confidence as a learner:

> we’ve been working at the moment on word problems in maths, but multi-step word problems. And one of the girls who I have actually been thinking of, she really struggled yesterday, got really upset with it because she couldn’t take all of this information and work out okay how do I get there. There is too much information and I can’t process all of that. So then when I gave her just a one step, so you just have to find the one thing to do, she could do it and felt a lot more confident. But when you gave her maybe two or three steps in a problem, she couldn’t work out where to start with it (page 7, line 214).

Alongside the impact on self-esteem and confidence, Chrissie details the resulting frustration and disappointment experienced by students. Her mention of students 'working really hard at that' but 'getting knocked down' suggests that some students with memory difficulties are caught in a cyclical pattern where hard work and effort does not always correlate with achievement.

> I also have got a number of children who I can think of who they are doing as they are asked to do, they are working really hard at that, but when it comes to their learning, they are getting knocked down or frustrated by not remembering small things that they know we have learnt about or they know they should remember...and I think that can be quite frustrating for them I have noticed…we try not to get them to feel negative about it but it's a lot of repetition and I think they recognise the repetition. They can't see that they are making progress and I think that can be quite disappointing for them as well and disheartening (page 2, line 61).

Matthew

Similarly to Zoe, Matthew also details how the student he thought of would be daydreaming by "staring off into space a little bit" (page 2, line 48). Alternatively he notes how the student may be "distracted and talking quietly to somebody else" (page 2, line 48). These behaviours suggest that the lack of focus can result in either a passive or active presentation in class.

In addition, Matthew notes when "I have set them off on a task and they get stuck, they might just sort of be sat there" (page 2, line 49). Waiting for, and being willing to accept adult support are similar to behaviours detailed by Gemma. Similarly to other teachers, Matthew also suggests that such difficulties are apparent across the curriculum but "definitely for written tasks" (page 3, line 70). This therefore suggests that although memory difficulties may affect many aspects of learning, they heavily impact tasks with a written element.

Caroline

Caroline detailed how the student who came to mind often struggled to retain learnt information over time. For example, she notes how the student "can do the process in maths one day, in a test or something, but then a few days later they have got to apply it again and it doesn't quite work the same" (page 8, line 238). The following example illustrates how this is a day-to-day problem for students and highlights the impact on everyday classroom tasks:

> both of them can just get confused with simple sentence structure so remembering capital letters and full stops. And sometimes one of them will really try and use kind of more exciting punctuation but it will be "where do I put the exclamation mark again?" "Should I put it here?" "Do I need an exclamation mark and a full stop?" (page 5, line 162).

The above example also illustrates the student's desire to check in with the teacher to ensure the task is completed correctly. This is evident from Caroline's comments of students seeking 'clarity' and 'reassurance', suggesting that students may lack confidence in their ability: "maths is probably the biggest one for both of them…just with clarity of what they need to be doing I think...and a bit of reassurance" (page 5, line 145). Caroline also details how difficulties with retention or memory may lead to some students presenting as unsure how to begin the task: "one of the first ones I mentioned, they wouldn't have necessarily got started because they wouldn't necessarily know what to do or have remembered what to do" (page 4, line 114). This therefore illustrates how students may present as passive in the classroom or reluctant to begin a task, but this is underpinned by students forgetting what to do, being unsure or perhaps feeling anxious about whether they are completing the task correctly.

Jamie

When asked to think about a child who struggles with learning (and may therefore have working memory difficulties), Jamie commented how the student he thought

of would often struggle to maintain focus and present in an inattentive manner. He highlights the observed discrepancy between the student and their peers:

> they do find it particularly tricky to maintain that focus and that is why at first glance, it might be that they can seem disengaged, they can seem like they are not with the rest of the class but it is often because of that I believe their inability to maintain that concentration for the same amount of time as their peers (page 2, line 62).

The consequences of this lack of focus and concentration were noted. In particular, the impact on the student's emotional presentation within class:

> the individual who I have in mind does find it particularly tricky to as I mentioned to keep up and maintain that concentration for a longer period of time but then if they don't and they feel like they are behind with it, they can become more reserved. A bit quieter and a bit more, you know if they feel like they haven't been helped or feel like they can't do it independently, they can become a bit more introverted with that as well (page 4, line 103).

Jamie noted that these difficulties were likely to be observed across different lessons including maths where the student has "a very negative perception of their own abilities within that" (page 4, line 130). It was noted, however, that presentation may vary according to the type of task. Similarly to Gemma, Jamie noted how creative tasks can be used as a buffer and help to mediate difficulties experienced across other curriculum subjects.

> there are certain areas of the curriculum they enjoy more. They are a very creative individuals so they, and from what I have seen and what I have heard from when they have worked with other adults and have been in other year groups, it is their mindset of thinking. If they think they are doing something creative, it sometimes lures them into doing things that they otherwise might have a closed mindset towards (page 4, line 119).

4.3 Classroom Presentation Themes

Conducting the reflexive thematic analysis generated three main themes and a few subthemes, which are depicted in Figure 13. I will explore these themes in greater depth and discuss how they link with research literature from the field of working memory in Chapter Seven. However, a short summary of the themes and key findings regarding teachers' views and understanding of working memory difficulties (which relate to research question one) is provided below:

Theme One: Perceptions and Impressions

- Subtheme One: Difficulties with attention and focus
- Subtheme Two: Difficulties with processing / managing cognitive load
- Subtheme Three: Difficulties with retaining and recalling learnt information

The findings reflect that there is a lack of awareness of the term *working memory* within teaching. Despite this, teachers' perceptions and understanding of working memory difficulties is that students exhibit difficulties with attention / focus, processing or longer-term retention in the classroom. Classroom presentations of behaviour may include students daydreaming, being distractible, displaying a lack of engagement on tasks and talking to other peers. In addition, students may struggle to process large amounts of information (such as multiple instructions) and may find it difficult to retain learning over a period of time or transfer this learning to other tasks.

Theme Two: Feelings, Emotions, Affect and Independence

There is an emotional impact of such difficulties on student self-esteem, confidence and self-efficacy as a learner. Students can become frustrated or reserved, and may seek adult support. Creative or practical tasks can be a buffer for these negative feelings.

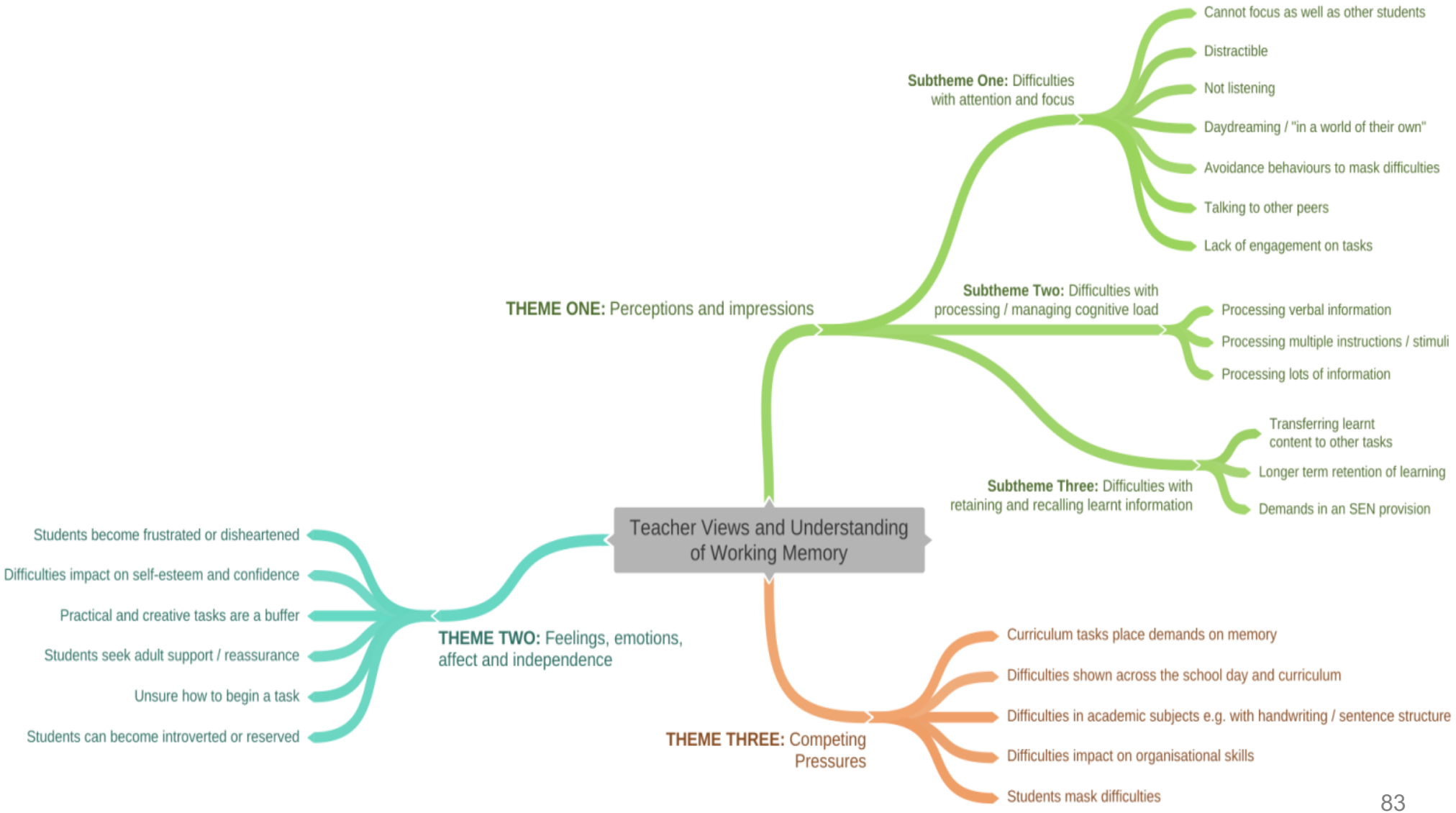
Theme Three: Competing Pressures

Difficulties can be exacerbated by competing pressures, including the pressures of the curriculum (which may indicate why lack of attention or issues with long term retention are salient problems for teachers).

Based on these teacher views and understanding of working memory difficulties, Part Two will now explore the teaching adaptations used by teachers within class.

Figure 13

Thematic map illustrating teachers' views and understanding of working memory



Part Two – Teaching Adaptations for Students with Working Memory Difficulties

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4.4 Individual Teacher Adaptations

Appendix 23 provides a summary of all ten teachers' reported teaching adaptations used for students who have difficulties with their learning (and who therefore may have working memory difficulties). Due to space constraints however, this chapter will explore the teaching adaptations for the seven teachers who undertook coaching in detail, including whether these adaptations are based on implicit knowledge or informed by research evidence.

Rachel

When asked how she adapts her teaching for students who have difficulties with their learning (and therefore may have working memory difficulties), Rachel commented that she uses visual aids such as a marker to assist with tracking when reading or writing. Rachel notes how this assists the student because "even if she [the student] has got distracted and looks away, she knows that the next word is expected there" (page 3, line 99). Other adaptations include visual now / next support, alongside shorter activities such as a carousel lesson structure:

> in terms of adapting my teaching for these two, I think the carousel works because… it is only 10-15 minutes per activity, I think for children like most of the ones in the classroom who have a short attention span, really do a focused 10 minutes and then they know something new is coming on rather than a whole 45 minutes of only doing writing (page 7, line 232).

As Rachel highlights, she believes that adaptations such as the carousel structure have a positive impact on student focus and engagement. This links with the 'Difficulties with attention and focus' subtheme in Part One. In addition to the carousel structure, Rachel notes that she adapts her teaching to include learning breaks as these also promote focus and attention. She provides an

example of a typical learning break: “if the focus just isn’t there, then I might suggest that she [the student] goes and does me a job… so I might just send her into another class with ‘I need to go for a walk’ type note” (page 8, line 252). Rachel notes the positive impact of these learning breaks, explaining that “having done a job, she [the student] will come back much fresher” (page 8, line 257).

In addition to promoting student focus and attention, Rachel detailed how she hoped such adaptations will “help her [the student] organisationally” (page 7, line 228) and allow students to be “more independent and have greater self-esteem to have a go and make mistakes in a safe way” (page 9, line 281). As such, there is a notion from Rachel that she hopes her teaching adaptations will build student organisational skills, independence, resilience and self-efficacy. Such adaptations link with the ‘Feelings, Emotions, Affect and Independence’ theme in Part One.

Rachel’s teaching adaptations appear to be based on implicit knowledge, because she did not specifically state that the strategies were intended to improve working memory, nor did she refer to any research evidence. Rachel did note however, the tension between her desire for continued professional development (CPD) and the financial and time constraints that limit this. She explains “I’m just keen to keep learning more and any ideas I just find really helpful.. it’s quite hard to get courses and stuff at the moment. Obviously financial costs, and time you know” (page 2, line 53).

Gemma

When discussing how she adapts her teaching for students who have difficulties with their learning (and therefore may have working memory difficulties), Gemma noted intangible methods of support such as “adult support to move onto each step of the activity, and explanation for each step of the activity” (page 4, line 116) or modelling tasks:

> I usually model it first, show them what they are going to do, then ask them to copy what I have done and then we will move onto the next one where I will model what to do and then they will do it themselves (page 4, line 129).

Gemma also discussed tangible teaching adaptations including the use of a workstation or "break[ing] it down step by step so that they can understand in small segments" (page 5, line 148). Gemma details how "a lot of their [the students] work is practical erm because they are quite visual and they understand it more if they have been able to see it first" (page 4, line 128). She later detailed:

> practical I think is less daunting for them than having to record it because it doesn't matter if they get it wrong. You can move the equipment away and start again… sometimes we just record it through pictures, drawing around the equipment, things like that (page 5, line 151).

Gemma's example illustrates how for some students (including those with possible working memory difficulties), the flexible and disposable nature of practical tasks can buffer negative feelings. This is because practical tasks promote accessibility, student engagement and link with the 'Feelings, Emotions, Affect and Independence' theme in Part One. Gemma highlights how practical tasks can also promote student independence, empower students with their learning and assist processing:

> when it is practical, they are more willing to try it themselves. So it helps to create independence… so a practical I think gives them the ownership of it being their learning and their task that they can do. I think because they can see it, it helps them to process it easier (page 6, line 175).

Similarly to Rachel, Gemma's teaching adaptations appear to be based on implicit knowledge. Her desire for teacher CPD was also evident as she states: **"**I'm always into learning new things and finding out new things and I think that sometimes being a teacher you know you would get bored if you didn't keep trialling new things" (page 2, line 38).

Zoe

Zoe discussed how she is proactive in ensuring her teaching is adapted, using prompts and differentiation. However, Zoe highlights the tension of implementing such adaptations within the pressures of an everyday classroom:

> **Zoe:** I think about things that I can do like trying to make extra resources or having almost like a cheat sheet of things to look through. Or kind of differentiating it slightly, or I know that I have to go over to them and repeat the instructions. But it is tough when you have 30 very interesting characters (laughs)
> **Me:** I imagine, It's a lot isn't it? Lots of plates spinning in one go?
> **Zoe:** Exactly. I need to remember to do that and that and that (page 3, line 91).

Zoe illustrates other pressures such as the unwritten threshold of need before outside professionals become involved in supporting students: "a lot of them [students], it's not bad enough to warrant having people come in. You know there are bigger fish to fry" (page 3, line 80). Both of these pressures link to the 'Competing Pressures' theme identified in Part One.

Similarly to Rachel, Zoe hopes that any teaching adaptations will enable "progress in learning… more independence and a bit more confidence I would say" (page 4, line 125). This mention of increasing confidence links with the 'Feelings, Emotions, Affect and Independence' theme in Part One. In addition, Zoe notes how she hopes that adaptations will improve memory: stating "I am hoping that eventually it works on their memory… and I can do one instruction and then I can build to two" (page 4, line 105). Building up instructions illustrates how Zoe hopes to increase students cognitive load so they can manage multiple instructions or pieces of information. This links with the 'Difficulties with processing / managing cognitive load' subtheme.

Similarly to others, Zoe's teaching adaptations appear to be based on implicit knowledge rather than based on research evidence. She notes however, that she values reading research and gaining ideas from other teachers to develop her

practice and teaching adaptations. She explained she had previously heard about working memory because:

> I just see a lot of stuff on twitter…it's a lot of teachers, there are quite a few researchers on there. People who write different articles in journals or in magazines things like that. But a lot of it is teachers just trying to work out what to do (page 5, line 148).

The notion 'teachers just trying to work out what to do' invokes a sense that teachers can sometimes feel lost, and illustrates the importance and value of supporting peers and sharing good practice.

Chrissie

When asked how she adapts her teaching, Chrissie noted that she will break tasks into chunks, alongside repetition of key content. Her comment 'whole class teaching doesn't necessarily adapt' in the extract below illustrates how teaching adaptations are individualised for students:

> I think that the whole class teaching doesn't necessarily adapt but the way that I will talk to them, we might go back and remind ourselves of things or try and bullet point erm the steps to success for how we are going to get here, what we are going to do then. So they can lay out a plan of action I suppose, and then going back a lot to repetition and just doing the same smaller activities again (page 4, line 125).

Similarly to others, Chrissie's teaching adaptations appear to be based on implicit knowledge, but she spoke positively of the impact that teaching adaptations appear to have on student learning. She explained that she hoped such adaptations would build fluency and retention by giving "more fluency…so there is a more recent memory" (page 5, line 144). This links to the 'Difficulties with retaining and recalling learnt information' subtheme. In addition to this, Chrissie highlighted the positive effect of teaching adaptations on student emotional

wellbeing as they "try and build up that confidence" (page 4, line 131). Her extract below highlights the positive cognitions and feelings that result:

> their emotional…wellbeing as well, they seem a lot more positive after they have felt like "oh yeah I am doing better. I can see progress in myself." I think that there is progress and they feel it for themselves emotionally a little bit better about it I think…they have more confidence and think "yes I can do this next time" (page 5, line 152).

This extract illustrates how adaptations used by teachers can empower students by providing them with greater confidence and self-belief in themselves as learners. Such effects link to the 'Feelings, Emotions, Affect and Independence' theme in Part One. For Chrissie, it was also important for her to "find some ways to help them [the students] to access in the same way that everybody else does when they might have these sorts of issues around working memory" (page 2, line 45). This desire for students to access learning in the same way as their peers promotes a sense of inclusion.

Matthew

The teaching adaptations noted by Matthew included breaking down complex tasks into "step-by-step instructions" (page 3, line 91) or providing light touch adult support by "checking in with them" (page 3, line 97). Matthew hoped that such adaptations would aid student understanding and "help them make whatever kind of progress they can" (page 4, line 102). This illustrates the value Matthew places on ensuring that student progress is evidenced and suggests this may be a competing pressure for him.

Similarly to other teachers, Matthew's teaching adaptations appear to be based on implicit knowledge rather than research evidence. Matthew also highlighted how he had received support and ideas for teaching adaptations from the SENCo at his school, but had little contact with external professionals: "from our SENCo I have had like a couple of suggestions for what might help them. But no direct contact with anyone like yourself" (page 3, line 84). This comment perhaps illustrates the consequences of an invisible threshold of need, as discussed by Zoe.

Caroline

Similarly to Gemma and Matthew, Caroline makes reference to intangible teaching adaptations such as adult support and teacher modelling. She notes how adult support incorporates light-touch strategies by "talking them through it, then going away again" (page 7, line 228) rather than being a consistent support within the classroom. This provides a notion of promoting learner independence and ties in with the 'Feelings, Emotions, Affect and Independence' theme in Part One.

Other teaching adaptations noted by Caroline include chunking tasks or using prompts to support students. Caroline explains "if they are planning a piece of writing, I might have bullet points for what I want them to include" (page 7, line 219), and notes "for those children [with possible working memory difficulties], it might be something like an extra planning sheet. Maybe with boxes, maybe with little prompts in each box for each part of the text… sometimes post-it notes with some prompts on it" (page 7, line 224). Like Gemma, Caroline also described practical teaching adaptations by asking students to "put your finger on the evidence" (page 7, line 231).

The rationale for using such strategies was to consolidate knowledge and improve student fluency. Caroline explains that this is because demands intensify with age and "going forward they are only going to get more processing…they are going to get more on top of that and going to have to remember that as well as going back to the old stuff" (page 8, line 262). This extract illustrates the importance that Caroline places on early intervention for consolidation of learning, and therefore links to the 'Difficulties with retaining and recalling learnt information' subtheme.

Caroline highlights the importance of differentiation and notes how she may give "specific differentiated work" (page 7, line 234). Like Chrissie, she also states the importance of personalising teaching adaptations for both student and teacher: "there is no right or wrong way in teaching, there are a lot of ways. And you have to work out what is right for what child, and what is right for what class. And what is right for you" (page 3, line 97). This extract, alongside Caroline's comment that

she has “adapted to help them with it” (page 6, line 185) illustrates the flexible and personalised adaptations teachers make for individual students or classes. This reflects an individualistic nature that there is not a universal or one-size-fits-all adaptation.

Similarly to others, Caroline’s teaching adaptations appear to be based on implicit knowledge rather than based on research evidence, although her passion for engaging in research was evident: “I think any opportunity to take part in research, and look at research and look at what it tells us and develop your practice is just really good” (page 3, line 95). Caroline also expressed a desire to further her knowledge and teaching, stating how by taking part in the research she was hoping to:

> improve my teaching. And improving like strategies that I could use in the classroom that would make me a better teacher. That would like either make me a better teacher in terms of spotting when someone might have problems with this, or make me a better teacher in terms of helping children and how I could adapt to help them (page 13, line 435).

Jamie

When asked how he adapts his teaching for students who have difficulties with their learning (and therefore may have working memory difficulties), Jamie noted that this included differentiation of tasks and instructions, breaking them down as needed. He states how tasks are “tailored a bit more for them” (page 3, line 83) and discusses how this may look within the classroom: “you have to adapt how you speak or maybe the rate in which you are giving instructions, or erm the instructions that you are giving to particular groups or tables, however the children might be organised” (page 5, line 162). Examples of adapting tasks and instructions included using a now / next board or “1 / 2 / 3 instruction boards” (page 6, line 179). Such adaptations tie in with the ‘Difficulties with processing / managing cognitive load’ subtheme identified in Part One.

Jamie also discussed that teaching adaptations may include adult support. Unlike other teachers who described this in an intangible way, Jamie notes how adult support would be a 'visual thing', suggesting that support is permanent and noticeable:

> if it came to doing like an independent task or something like that, they often do have support in order to erm give them constant reminders or to you know like drip feed things that have been mentioned throughout that lesson so that is being used in their learning. So that would be a you know, a visual thing that you would notice if they often had someone working with them (page 3, line 70).

The resulting implications and competing pressures of this support, however, were discussed by Jamie. He illustrates how students can become over-reliant and the challenges of managing this: "the fine balance between them knowing that the support is there and not feeling that they are leaning on it entirely and thus losing the ability to engage independently" (page 3, line 95). Jamie notes how this over-reliance also extends to classroom peers:

> they have ended up over time erm becoming reliant upon other individuals within the class, as in their peers. Which at first is a really lovely thing as you can imagine, you know the fact that others want to try and support and be there for them. But with that comes over-reliance as well (page 3, line 76).

In addition to students becoming over-reliant on support, a second tension or competing pressure was ensuring that support is timely. Jamie explained that this was "knowing when to target them rather than doing it before it is needed or doing it too late and then we have lost the time window that was there for them" (page 4, line 109). The notion of a 'time window' suggests that Jamie views there is a key period where support can be most effective.

Like other teachers, Jamie's rationale for implementing teaching adaptations such as differentiation, breaking down tasks and adult support appears to be based on implicit knowledge rather than research evidence. Jamie states how he hopes that adaptations will allow children to 'feel like they are one of everyone'

suggesting that Jamie values and attempts to promote an inclusive learning environment: “my first and most important thing I feel for each and every child in the class is that you want them to feel like they are one of everyone” (page 6, line 195). In addition to promoting feelings of inclusion, Jamie also noted how he hoped that adaptations would enable the student to achieve the set learning objective, become secure in their learning and increase their independence. These aims link to both the ‘Feelings , Emotions, Affect and Independence’ theme and the ‘Competing Pressures’ theme.

Like many other teachers, despite the lack of research evidence behind his adaptations, Jamie spoke positively about opportunities for CPD and furthering his knowledge. For example, he positively reflected on the standards meetings at his school where he could share advice with colleagues. His extract below illustrates how sharing good practice with colleagues can be an enabling factor for progress, and a buffer against competing pressures and feelings of isolation:

> it’s really nice to have that forum to do that because without having that it can be very isolated if you feel you are suffering in silence and don’t know why this child, why you are not able to engage with them or why they are not engaging with you. It’s just nice to be able to sometimes, someone might have taught them the year before and be able to say “this worked very well!” and then it becomes something that is a conversation than a battle almost (page 8, line 242).

In addition, Jamie was passionate about furthering his knowledge of working memory through the research. His extract ties in with the ‘Competing Pressures’ theme identified in Part One, as it illustrates how Jamie experiences a sense of permissiveness and justification to invest time in the research in a teaching world with many other competing demands:

> with things like this, it will be really good to have a concrete reason to invest a bit more time in that area because I feel like, as I say, the best will in the world we have our fingers in so many pies and so many things that we have to try to achieve and we end up spreading ourselves so thinly that actually it is good to have a reason to invest my time in something (page 2, line 39).

Jamie spoke positively about the research and felt that it would allow working memory to be " in the spotlight more" (page 10, line 325): "I think it is interesting that you are engaging in this topic because some children it may have been attributed to different things previously, but… now, it has become something we can support and help with" (page 12, line 387). As such, Jamie illustrates how engagement in research to develop his own teaching adaptations is a form of early intervention with subsequent positive effects.

4.5 Teaching Adaptation Themes

The teaching adaptations mapped onto the same themes generated in Part One, which are depicted in Figure 14. I will explore these themes in greater depth and discuss how they link with research literature from the field of working memory in Chapter Seven. However, the key findings (which also relate to research question two) are:

Theme One: Perceptions and Impressions

Subtheme One: Difficulties with attention and focus

Subtheme Two: Difficulties with processing / managing cognitive load

Subtheme Three: Difficulties with retaining and recalling learnt information

Teaching adaptations were predominantly focused on:

- Improving student attention / focus through the use of shortened activities, learning breaks and physical activities such as workstations.
- Helping students to process multiple pieces of information and manage cognitive load by breaking down instructions or tasks into smaller chunks or steps, providing clear instructions, using visuals to support and modelling tasks.
- Aiming for long term consolidation and retention of learning through repetition of key content and using multi-modal strategies to support learning.

It should be noted that most teachers did not explicitly state that such adaptations were in place to assist with supporting working memory.

Theme Two: Feelings, Emotions, Affect and Independence

Teaching adaptations also aimed to increase student resilience, self-esteem, independence and confidence by building on strengths, using practical or creative resources and providing adult support where needed.

Theme Three: Competing Pressures

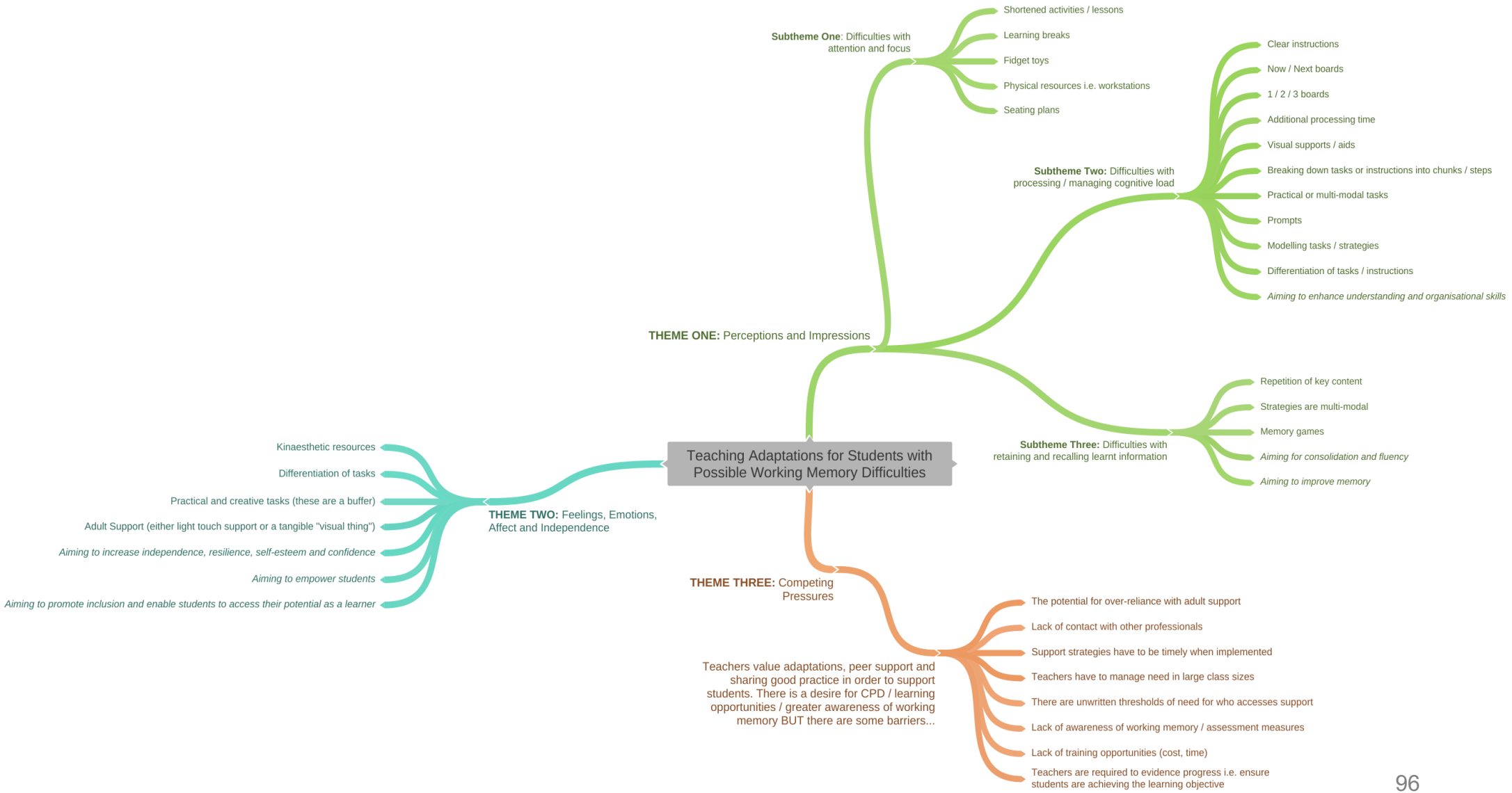
The current climate of austerity led to several competing pressures for teachers regarding the implementation of teaching adaptations. These pressures included the lack of access to professionals or training to support, the management of need, and multiple demands placed on teachers (including large class sizes or the requirement to evidence student progress).

All teaching adaptations and strategies discussed were based on teachers' implicit knowledge rather than research evidence based.

This chapter has presented my findings from Phase One of the research. Chapter Five will present the findings from Phase Two.

Figure 14

Thematic map illustrating teaching adaptations



Chapter 5: Findings From Phase Two

This chapter will present the findings for Phase Two of my research. The aim of Phase Two was to identify students for Phase Three who may be 'at risk' of having working memory difficulties. This phase, therefore, consisted of a two-part identification process using the Working Memory Rating Scale (WMRS), followed by standardised assessment if appropriate using the Wechsler Intelligence Scale for Children Fifth UK Edition (WISC V) and the Wechsler Nonverbal Scale of Ability (WNV). This phase will address research questions three and four:

Research Question Three: What is the pattern of working memory functioning in those students classified as "at risk of working memory difficulties" from the WMRS, WISC V and WNV test norms?

Research Question Four: To what extent do the teacher ratings from the WMRS relate to student scores obtained on the WISC V and WNV?

5.1 Research Question Three

To explore the pattern of working memory functioning in students deemed to be "at risk of working memory difficulties" by school SENCos, I calculated descriptive and frequency statistics for the rating and assessment measures; the WMRS, WISC V Working Memory Index (WMI), WISC V Auditory Working Memory Index (AWMI) and WNV. See Appendix 14 for the full SPSS Output.

5.1.1 Pattern of working memory functioning on the WMRS

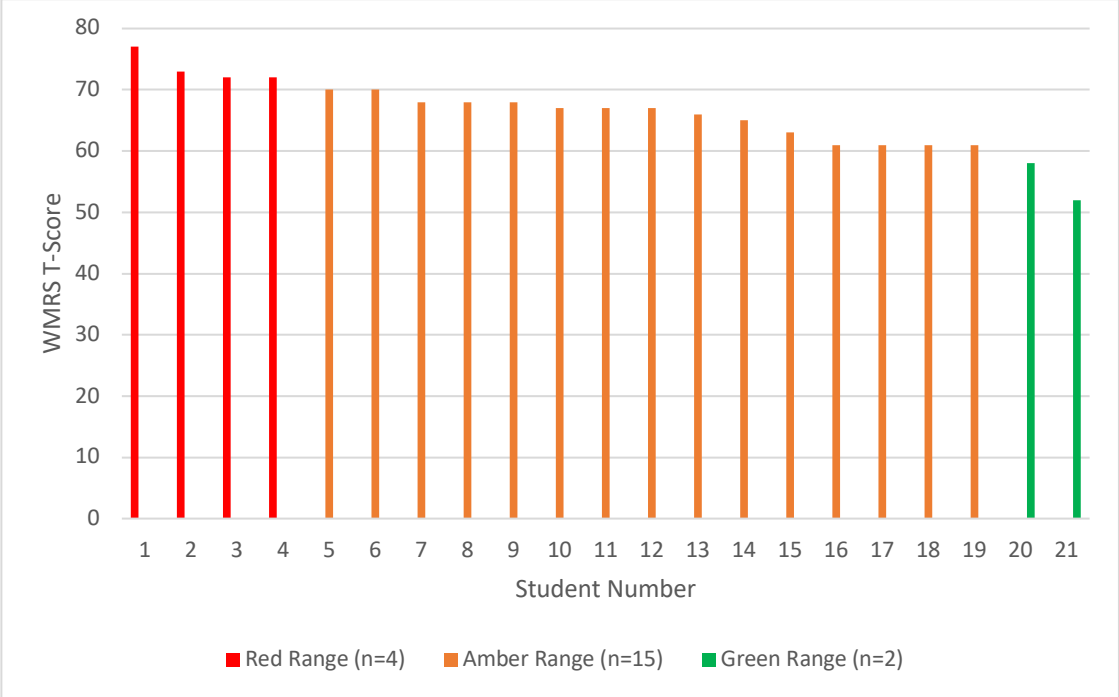
The first stage of identification involved teachers completing the WMRS, a 20 item short teacher rating measure designed to differentiate between children with low and average working memory abilities. The maximum score on the WMRS is 60, with higher scores indicative of a greater degree of working memory difficulties. Across all schools, teachers completed the WMRS for twenty-one students (N = 21) and the mean WMRS score was 38.24 (*SD* = *8.67*). Percentiles were also calculated, with lower percentiles indicative of a greater degree of working memory difficulties (M = 10.86, SD = 9.60). The scoring for the WMRS also generated T scores. However, please note that the T-scores for the WMRS

are reversed in comparison to T-scores typically used on the WNV or WISC V. This means that higher T-scores are indicative of a greater degree of working memory difficulty. The mean T-score for the sample was 65.90 (SD = 5.89).

T-scores determine the classification ranges. Those with a T-score of 60 or below fall in the “Green” range. Those with a T-score between 61-70 (more than one SD from the mean) fall in the “Amber” range. Those with T-scores of 71 or above (more than two SD from the mean) fall in the “Red” range. Figure 15 displays the WMRS T-scores and classification for individual students.

Figure 15

WMRS T-scores for each student



Two students scored in the “Green” range, meaning that they were unlikely to have working memory difficulties and follow up standardised assessment was therefore not completed. The majority of students, however (n=19), scored within either the “Amber” or “Red” range, suggesting that they may have working memory difficulties. Consequently, this sample (n=19), had a higher average WMRS score (M = 40.00, SD = 6.84), higher average T-score (M = 67.05, SD = 4.79) and lower average percentile (M = 8.63, SD = 5.83). The results, indicate that these nineteen students were rated by teachers as having a greater degree of working memory difficulty, and I therefore conducted individual follow-up standardised assessment work using the WISC V and WNV.

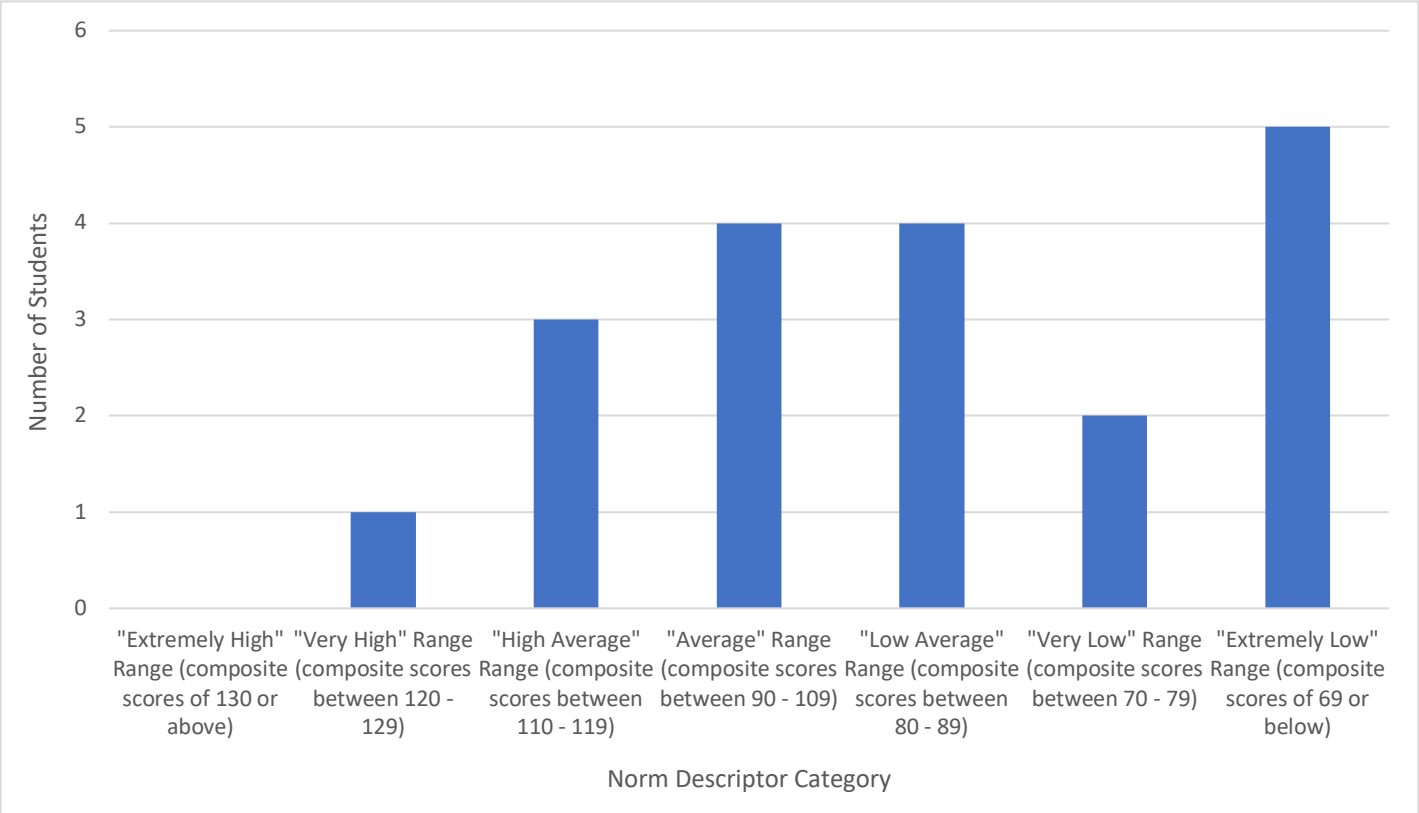
5.1.2 Pattern of working memory functioning on the WMI, AWMI and WNV

The follow-up assessment work using the WISC V and WNV formed the second stage of identification. T-scores and composite scores (where possible) were calculated for each student on each of the three indexes; WISC V Working Memory Index (WMI), WISC V Auditory Working Memory Index (AWMI) and WNV Index.

All nineteen students completed the WMI. The average composite score is 100, with scores between 90-109 deemed to fall within the average range. The mean index composite score for the sample was 84.79 (SD = 22.63), the mean percentile was 29.23 (SD = 31.68) and the mean T-score was 39.66 (SD = 15.00). See Figure 16 for a graph illustrating the frequency breakdown of students who scored in each norm descriptor category.

Figure 16

Frequency of students scoring within each norm descriptor category for the WMI



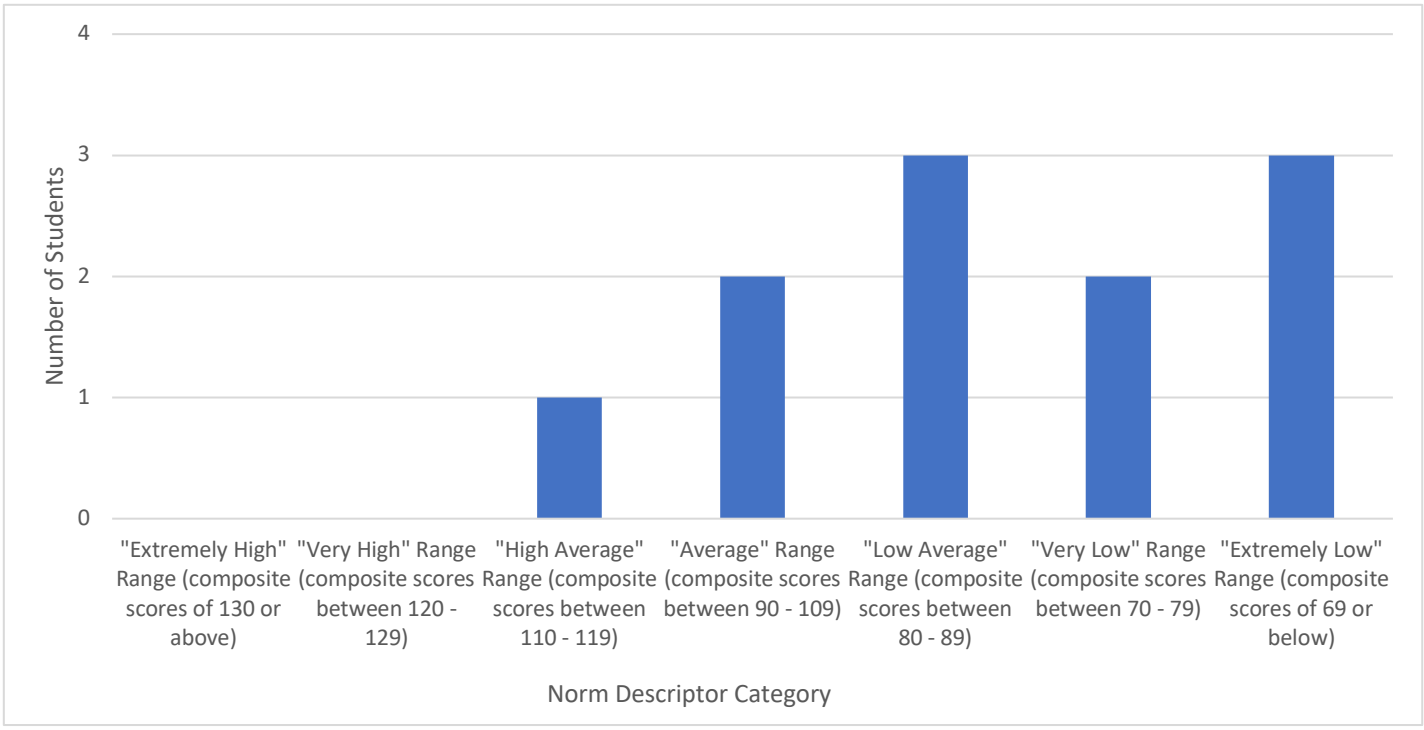
I classified any students who scored in the “Low Average” range or below as “at risk of having working memory difficulties”. Out of the 19 students who completed

the WMI, this meant 11 students were “at risk.” For these 11 students (n=11), the mean index composite score was 70.27 (SD = 16.19), the mean percentile was 7.66 (SD = 8.47) and the mean T-score was 30.05 (SD = 10.60).

The second index score calculated was the AWMI. Eight students did not complete the Letter-Number Sequencing subtest due to a range of factors including refusal, fatigue or a lack of understanding of the task requirements. As this subtest is required to calculate the AWMI, I could therefore only obtain an index score for the 11 students who completed the subtest (n=11). The average composite score for the AWMI is 100, with scores between 90-109 deemed to fall within the average range. Of the 11 students who completed the subtest, the mean index composite score was 80.27 (SD = 19.57), the mean percentile was 21.05 (SD = 25.29) and the mean T-score was 36.50 (SD = 12.87). The frequency breakdown of students who scored in each norm descriptors category is displayed in Figure 17 below:

Figure 17

Frequency of students scoring within each norm descriptor category for the AWMI.



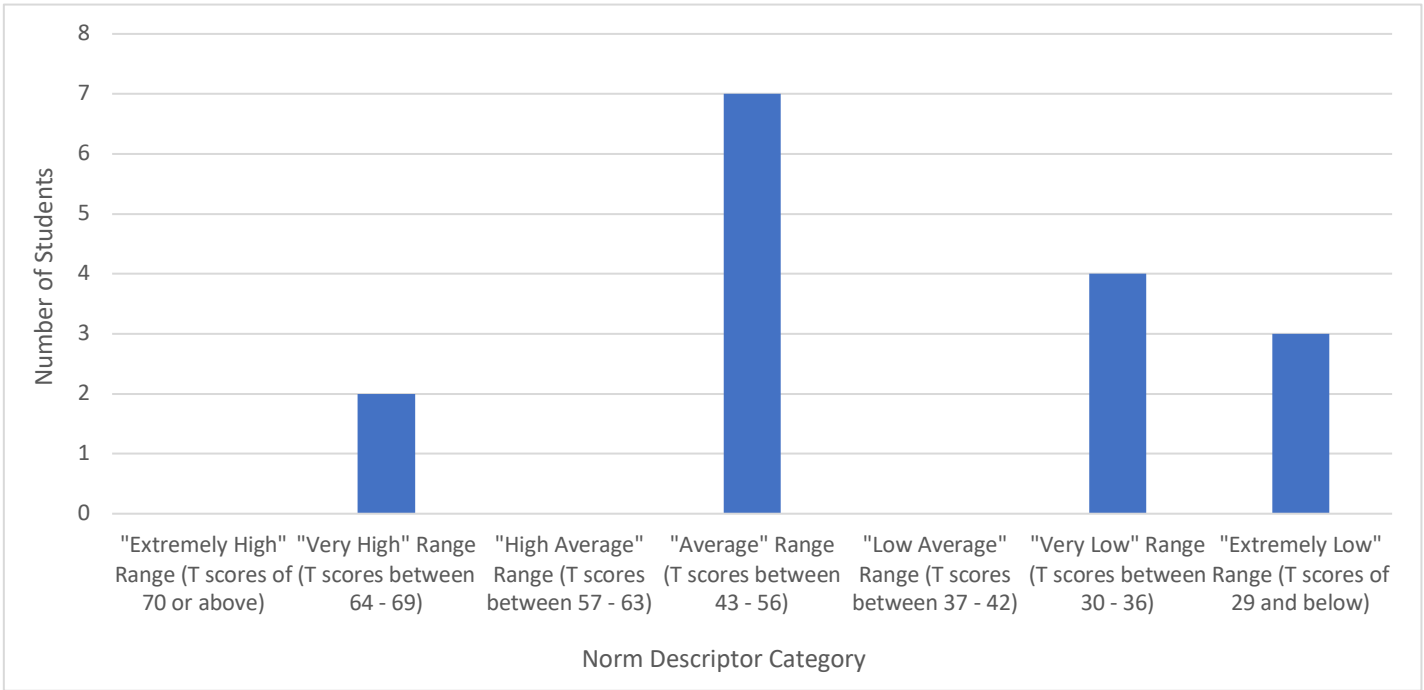
Similarly to the WMI index, I classified those who scored in the “Low Average” range or below as “at risk of having working memory difficulties”. Out of the 11 students who completed the AWMI, eight students were “at risk.” For these eight students (n=8), the mean index composite score was 72.25 (SD = 15.66), the mean percentile was 8.81 (SD = 9.91) and the mean T-score was 31.19 (SD = 10.21).

The final index score was the WNV, which was calculated for sixteen students (n=16). Three students did not complete the WNV assessment because the norms of the assessment begin at 8 years, 0 months and their chronological age fell below this at the time of testing (7 years, 3 months – 7 years, 4 months). A psychometric conversion table was used to calculate the percentile and norm descriptor from the T scores.

Of the 16 students who completed the WNV, the mean T score was 42 (SD = 15.65) and the mean percentile was 35.64 (SD = 34.39). Figure 18 displays the frequency breakdown of students who scored in each norm descriptor category.

Figure 18

Frequency of students scoring within each norm descriptor category for the WNV



Similarly to the WMI and AWMI, I classified those who scored in the "Low Average" range or below as "at risk of having working memory difficulties". Out of the 16 students who completed the WNV, seven students were "at risk." For these seven students (n=7), the mean T score was 27 (SD = 8.04), and the mean percentile was 2.90 (SD = 3.14).

5.2 Research Question Four

Table 16 illustrates the Spearman's Rho correlations conducted between the teacher ratings from the WMRS and the student T-scores obtained on the WMI, AWMI and WNV. See Appendix 14 for the full SPSS Output.

Table 16

Spearman's Rho correlational analyses between the WMRS, WMI, AWMI and WNV T-scores.

Correlational Analysis	Spearman's Rho	Strength of Relationship	Significance
WMRS T-score and WMI T-score	r_s = .-.34, n = 19, p = .08	Medium	No
WMRS T-score and AWMI T-score	r_s = -.21, n = 11, p = .27	Small	No
WMRS T-score and WNV index T-score	r_s = -.32, n = 16, p = .12	Medium	No

Although the correlations have a small to medium association and range from r_s = -.21 to r_s = -.34, none of the correlations are significant.

The results suggest that within the sample, there is a medium-strength negative association between the WMRS T-scores and the WMI T-scores, and between the WMRS T-scores and the WNV T-scores. There was a small negative association between the WMRS T-scores and the AWMI T-scores. The associations are negative due to T-scores on the WMRS being reversed in comparison to T-scores for the WNV or WISC V.

However, these were not strong associations, nor statistically significant, so it cannot be concluded that teacher ratings from the WMRS were associated with working memory test performance. Table 17 illustrates a full breakdown of student WMRS T-scores and the subsequent follow up assessment scores. Despite seven of the students scoring within the "Amber" range on the WMRS, these students did not score within the "Low Average" range on the standardised assessments and were therefore not deemed to have difficulties with their working memory.

Table 17

Student WMRS T-scores and subsequent eligibility for teacher coaching

Pupil Number	WMRS T-score (and Classification)	Scored in the "Low Average" range on either the WISC V or WNV and therefore deemed to be "at risk of having working memory difficulties." (✓ or X)
1	77 (Red)	✓
2	73 (Red)	✓
3	72 (Red)	✓
4	72 (Red)	✓
5	70 (Amber)	✓
6	70 (Amber)	✓
7	68 (Amber)	✓
8	67 (Amber)	✓
9	67 (Amber)	✓
10	65 (Amber)	✓
11	63 (Amber)	✓
12	61 (Amber)	✓
13	68 (Amber)	**X**
14	68 (Amber)	**X**
15	67 (Amber)	**X**
16	66 (Amber)	**X**
17	61 (Amber)	**X**
18	60 (Amber)	**X**
19	59 (Amber)	**X**
20	58 (Green)	N/A – student was not assessed
21	52 (Green)	N/A – student was not assessed

Note: ✓(N=12) ***X*** *(N= 7)*

I conducted additional Spearman's Rho correlations to examine the relationship between the WMI or AWMI T-score and the WNV T-score. The correlation between the WMI and AWMI is not reported as the indexes share subtests, meaning they are likely to correlate. Table 18, Figure 19 and Figure 20 display the results of the correlations between the WNV and either the WMI or the AWMI.

Table 18

Spearman's Rho correlational analyses between the WNV and WMI / AWMI T-scores.

Correlational Analysis	Spearman's Rho	Strength of Relationship	Significance
WNV T-score and WMI T-score	r_s = .81, n = 16, p = <.001	Large	Yes
WNV T-score and AWMI T-score	r_s = .90, n = 8, p = .001	Large	Yes

Figure 19

Scatterplot showing the correlation between the WNV T-scores and WISC V WMI T-scores.

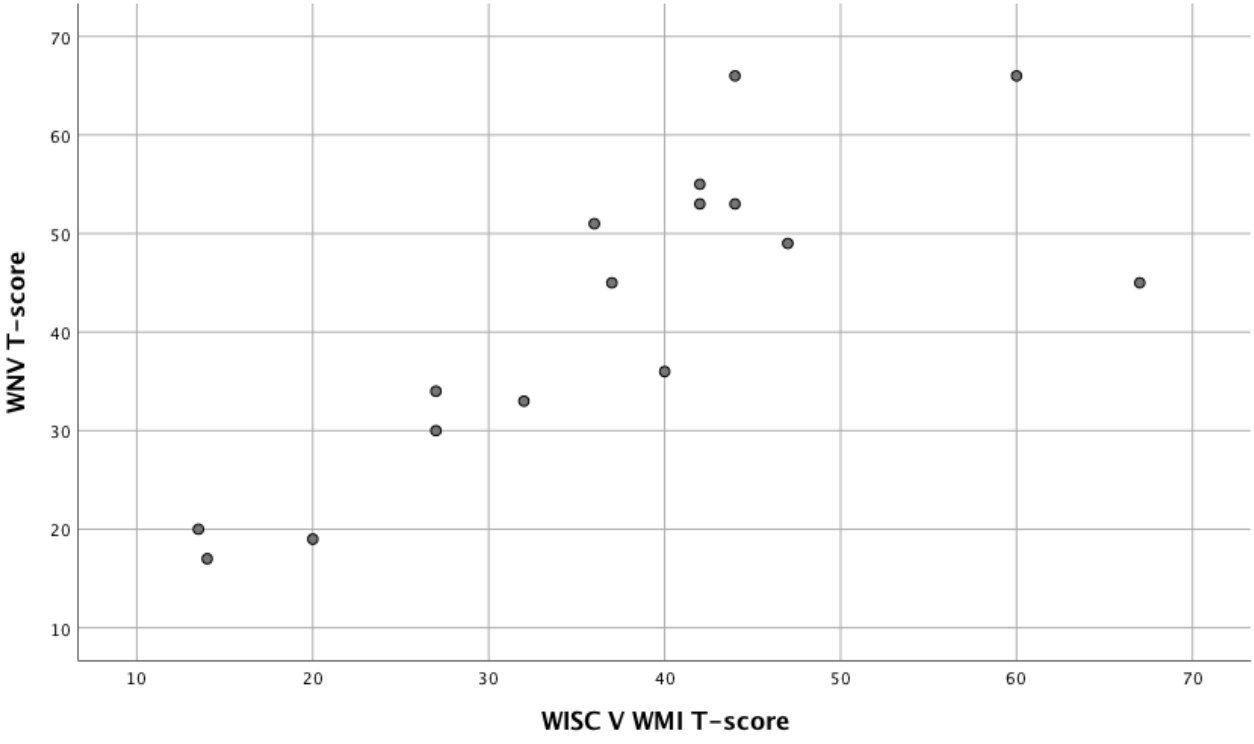
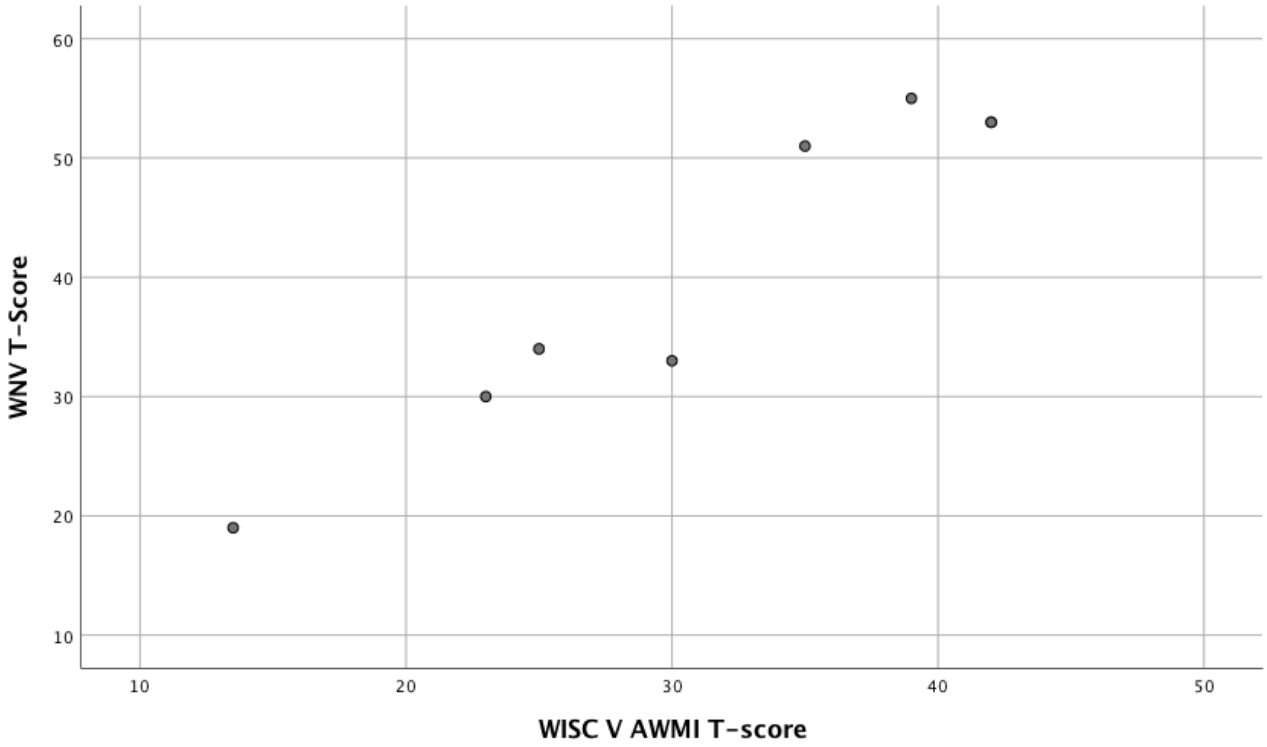


Figure 20

Scatterplot showing the correlation between the WNV T-scores and WISC V AWMI T-scores.



These results indicate that within the sample, there is a significantly strong correlation between the WMI and WNV T-scores and between the AWMI and WNV T-scores. This indicates that student performance on either the WMI or AWMI was closely tied to performance on the WNV. In other words, this suggests that there is a close relationship between the skills that both assessments measured and students who performed poorly on one measure were also likely to perform poorly on the other measure.

I will explore the findings from Phase Two and discuss how they link with research literature in Chapter Seven.

The key findings in relation to research questions three and four are:

- Teacher ratings on the WMRS placed 90% of students (n=19) within either the “Amber” or “Red” range, suggesting that they were at risk of having working memory difficulties. Of these 90%, 69% of students (n=15) scored within the “Amber” range and 21% (n=4) scored in the “Red” range.

- Of those nineteen students who scored in the “Amber” and “Red” range, between 44% and 73% of students scored within the “Low Average” range on the WMI, AWMI or WNV indexes.

- The teacher ratings from the WMRS did not have a strong, nor statistically significant association with the student scores obtained on the WMI, AWMI or WNV. Therefore it cannot be concluded that teacher ratings on the WMRS were associated with working memory test performance.

- Student T-scores on the WMI, AWMI and WNV had a strong significant correlation with each other, suggesting that performance on either the WMI or AWMI was closely tied to performance on the WNV and vice versa.

This chapter has presented the findings from Phase Two of my research. Chapter Six will present the findings from Phase Three.

Chapter 6: Findings From Phase Three

This chapter will present the findings for phase three of my research. The aim of phase three was to explore whether a coaching intervention could be used with Key Stage Two teachers to develop their understanding of working memory, and implement research informed approaches into their classroom teaching.

In this chapter there are two main sections. Part One illustrates the coaching process using one case pupil Emma* and her teacher Chrissie*. Due to space constraints, only one teacher case study (out of seven) is illustrated and this was chosen at random. Part Two presents a cross-coaching analysis of all coaching sessions, before evaluating the impact of coaching. Together, both Part One and Part Two address research questions five and six:

Research Question Five: To what extent can a coaching psychology intervention used with Key Stage Two teachers develop their understanding and identification of working memory difficulties, and implement research informed approaches into their teaching practice?

Research Question Six: To what extent do teachers' views and understanding of working memory difficulties change following a coaching psychology intervention?

* names have been changed to ensure anonymity

6.1 Case Pupil Emma*

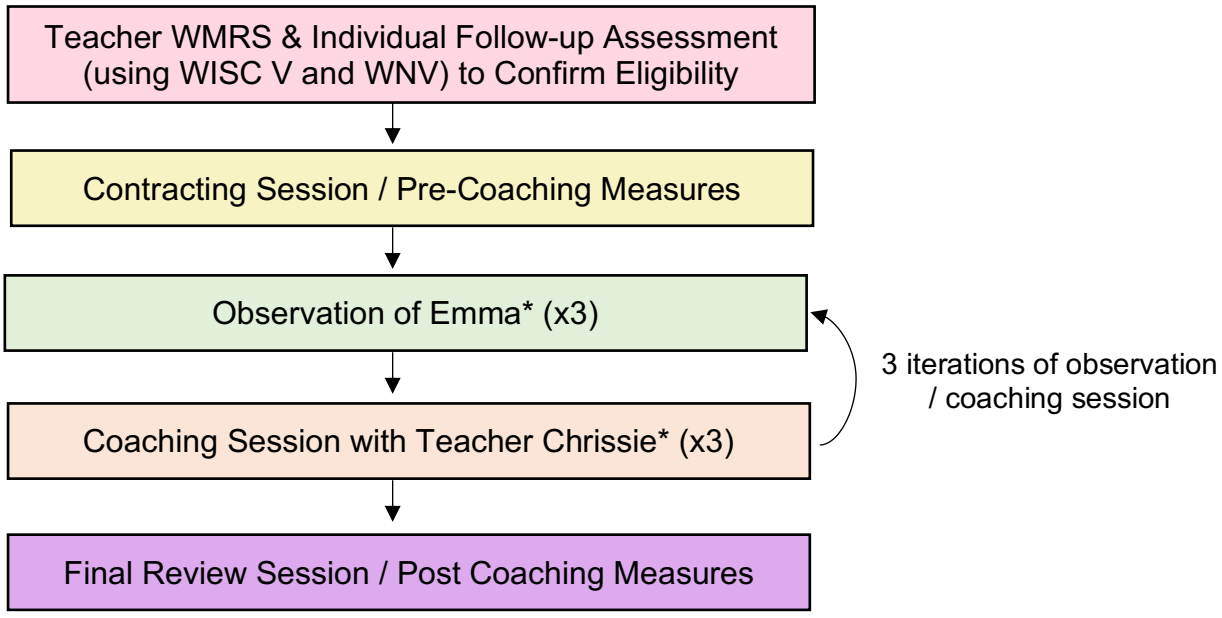
Emma is a ten year old girl in Year 6 at a mainstream primary school. The school felt that Emma may be suitable to be a case pupil in the research as she was struggling with aspects of her learning but had not previously received any input from the local authority Educational Psychology Service. Her class teacher requested to take part in the research because she:

- Wanted to help learners with working memory difficulties increase their independence.
- Wanted to help learners with working memory difficulties increase their self-esteem and confidence.
- Wanted to develop a better understanding of working memory.

The process of my coaching involvement with this case is illustrated in Figure 21 below:

Figure 21

Coaching process for teacher Chrissie and case pupil Emma**



6.1.1 WMRS and Follow Up Assessment Results

On the WMRS, Emma scored on the 14th percentile which fell within the "Amber" range. In the follow-up individual assessment work, Emma scored within the "Low Average" range on the WISC V Working Memory Index. Her full results are displayed in Table 19 below:

Table 19

*Subtest and index scores for Emma**

Subtest / Index	Index Score	T Score	Percentile	Range Descriptor
Digit Span (WISC V) *Comprised of Digit Span Forward, Digit Span Backward and Digit Span Sequencing*			37	
Picture Span (WISC V)			5	
Working Memory Index *Comprised of Digit Span Forwards, Digit Span Backwards, Digit Span Sequencing and Picture Span.*	82		12	Low Average
Spatial Span Forwards (WNV)		33		
Spatial Span Backwards (WNV)		42		
WNV *Comprised of Spatial Span Forwards and Spatial Span Backwards*		45	32	Average

The results from Emma's performance on the WNV suggest that her visual spatial and kinaesthetic working memory ability is an area of relative strength. Emma's performance on the WISC V WMI however, was within the "Low Average" range. From pairwise comparisons conducted, Emma performed slightly better on the Digit Span Forward and Digit Span Backwards tasks than on the Digit Span Sequencing task, suggesting that she found it easier to remember and repeat back information (either verbatim or in reverse), rather than ordering or sequencing information. As Emma scored within the "Low Average" range for one of the indexes, this suggested she was "at risk of working memory difficulties".

Her class teacher Chrissie* was therefore offered a series of coaching sessions to support Emma's working memory.

6.1.2 Coaching Contracting Session

A coaching contracting session took place in June 2019 with the coachee (Chrissie) to clarify the focus of coaching, roles, ways of working and to set goals. It was agreed that because Chrissie would be keeping the same class and teaching Emma in the following academic year, coaching would take place in the 2019 Autumn Term. This was to ensure the coaching process was not rushed before the summer holidays. During the coaching contracting session, Chrissie completed the pre-coaching self-efficacy measure.

6.1.3 Observation One

The first observation and coaching session took place in mid-October 2019, and I observed Emma during an International Primary Curriculum (IPC) lesson. The observation was informal and non-judgemental, and recorded in a verbatim manner. The purpose of the observation was to explore Emma's presentation in class and note any strategies used to support her. The following was noted from this observation:

- Chrissie read through Emma's work with her and pointed out instances where the sentence did not make sense or where Emma needed to add punctuation.
- Chrissie modelled helpful strategies for Emma i.e. how to glue pages together to form a book. Emma appeared to respond well to this modelling and adult support. When Chrissie moved away, Emma would sometimes stop working.
- Emma also worked well with the peer next to her. When this peer got up, Emma asked "where are you going?"
- When she made a mistake in her writing, Emma started again with a fresh sheet of paper.

- Emma appeared to respond well to real world examples that illustrated the importance of punctuation i.e. thinking about how the Queen would speak.

6.1.4 Coaching Session One

After reading through the observation transcript, Chrissie stated that what I had observed is typical for Emma. Chrissie agreed that Emma likes support from peers or adults and stated how she felt Emma is capable but struggles to transfer learnt knowledge and apply this in her writing. I discussed with Chrissie how students with working memory difficulties can find it hard to apply learnt knowledge due to the required retention and cognitive load demands. Chrissie agreed that this was particularly noticeable in literacy tasks and highlighted an example where Emma struggled to remember to include multiple things in her work e.g. fronted adverbials / punctuation / conjunctions.

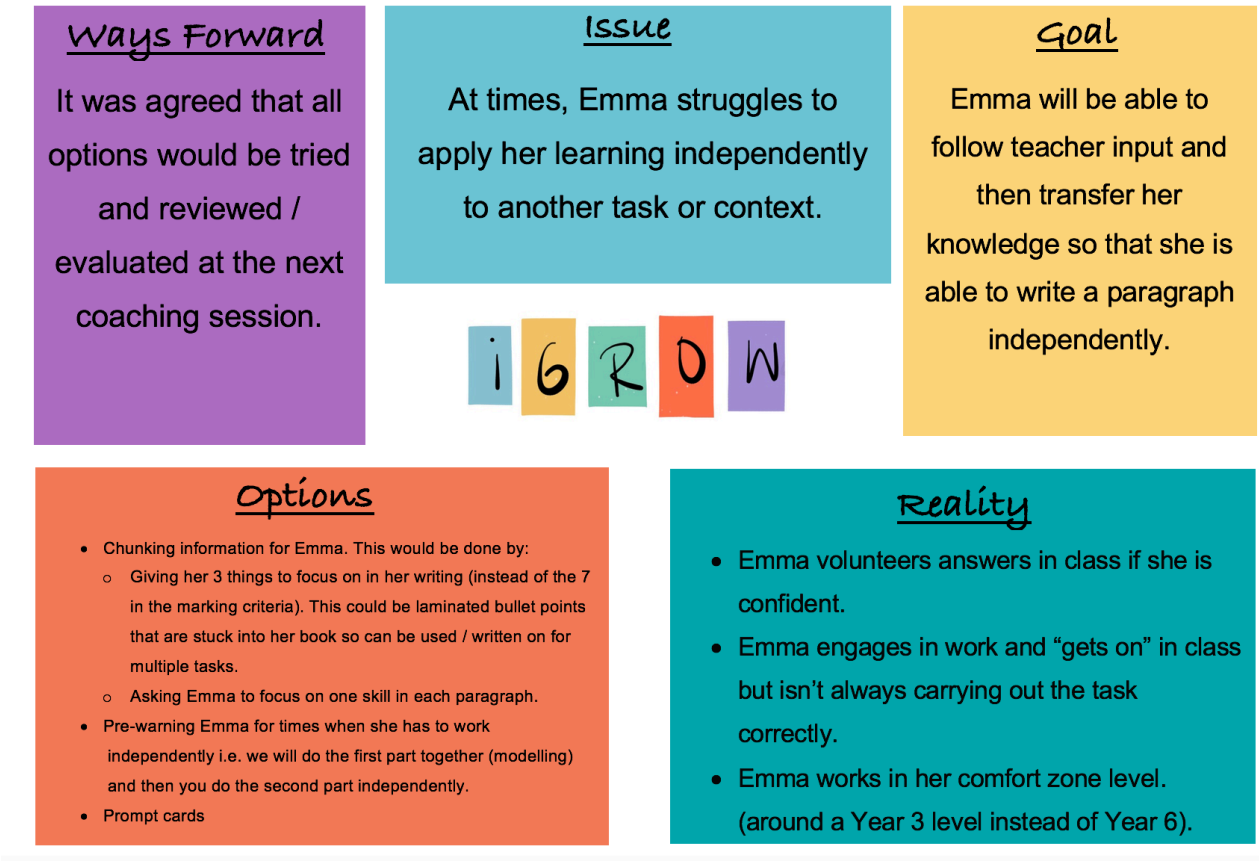
We then discussed how Emma appeared to respond well when Chrissie modelled tasks and how this may tie in with Emma's relative strength in her visual-spatial and kinaesthetic working memory ability (as shown in the WNV assessment results). I showed Chrissie the multi-component model of working memory (Baddeley, 2010) and discussed the functions of each component and how they link to particular brain areas and to Emma's learning. Chrissie noted at this point that despite Emma performing poorly on the Picture Span subtest, she responds well to visuals used in class. However, Chrissie wondered whether this was because Emma uses visuals in class to please Chrissie.

We then discussed how research literature suggests that over the course of childhood, children gradually develop their ability to rehearse verbally and become less reliant on visual formats. In relation to Emma, she was a summer-born and therefore younger than others in her class, so we discussed how her ability to rehearse verbally may still be developing. The I-GROW framework from coaching session one is illustrated in Figure 22. This provides a summary of the discussions that took place and was jointly completed between myself and Chrissie throughout the coaching session. The 'Issue' and 'Reality' sections depict the current situation based on my observation and the joint discussion.

Based on this information, the ‘Goal’ section provides a focus for what Chrissie would like Emma to be able to achieve before the next coaching session. Various research-informed options (see section 6.2) to achieve this goal were discussed and noted in the ‘Options’ section. The ‘Ways Forward’ section details the agreed actions to be implemented by Chrissie before the next coaching session, where they will be subsequently reviewed.

Figure 22

I-GROW framework for coaching session one



6.1.5 Observation Two

Three weeks later in early November 2019, I returned to the school for the second observation and coaching session. I observed Emma during an English lesson, where the learning objective involved writing a diary entry. The following was noted from this observation:

- Emma signalled to her peer where she should sit i.e. next to her (later explained to me by Chrissie that this peer is low ability).
- Chrissie asked the class to identify key features of a diary entry. Emma looked down at her book and did not put up her hand.
- When Chrissie asked the class "is there anyone who cannot remember what their next step is?", Emma put up her hand. Chrissie told Emma it was "making sure your tenses are consistent."
- Chrissie worked with Emma individually to explain the task and develop a bank of key words. Following this, Emma continued with her work.
- At one point during the lesson, Emma came over to Chrissie (who was on the other side of the classroom) and clarified whether she should be doing each of her 'top ticks' once or twice.
- Emma was able to identify strategies that would be helpful to her i.e. using a dictionary. However, this appeared to be a lengthy process for Emma. She got a dictionary from the shelf, sat down and realised it was wrong, and subsequently changed it.
- Towards the end of the lesson, Chrissie checked in with Emma and she had written a story instead of a diary entry (i.e. she had not written in the first person). This was possibly because she had struggled to keep the learning objective in mind. Chrissie said "Emma, everyone else is going to move on to do IPC but you can finish that if you want?" Emma chose to get her diary entry finished.

6.1.6 Coaching Session Two

After Chrissie read through the observation transcript, it was discussed that Emma's motivation as a learner is good and she wants to do well in her learning

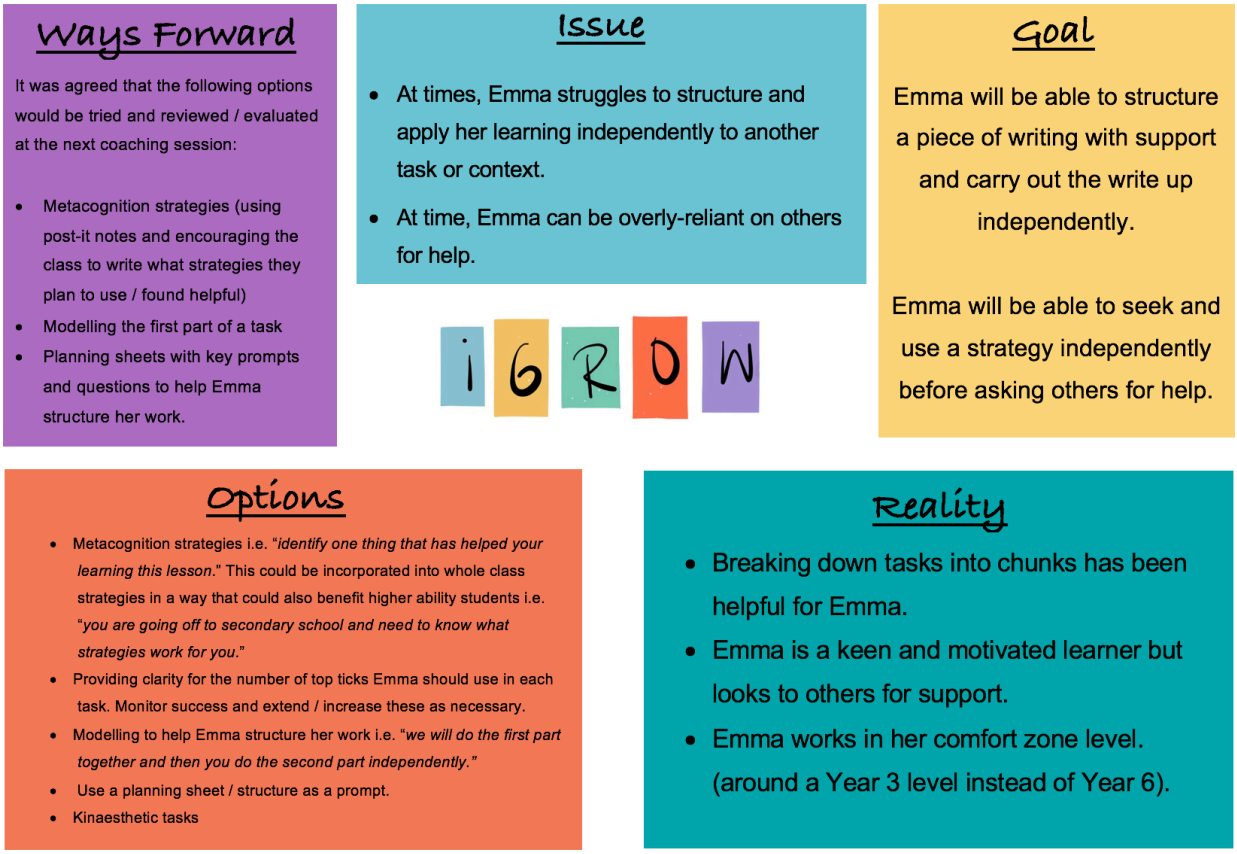
(as shown by her wanting to finish her diary entry task). Chrissie also picked out how Emma can be reliant on others for help and spoke about how it is a fine balance regarding who to place her next to. Chrissie detailed how she felt that checking with other people is Emma's 'strategy' in lessons, although I wondered aloud whether this could have the potential to be beneficial i.e. Emma having a peer memory buddy to support her memory.

This discussion about developing Emma's learning strategies developed into a conversation about Reuven Feuerstein and metacognition. For example, how principles of metacognition could be built into learning to encourage all students to reflect on strategies they found helpful for their learning. I highlighted to Chrissie how I had noticed that some elements of this were already happening in the classroom i.e. another student knowing that writing on a whiteboard before copying into their book was beneficial.

Review of Previous Goal. The previous goal (Emma will be able to follow teacher input and then transfer her knowledge so that she is able to write a paragraph independently) was reviewed. Chrissie reflected on strategies she had tried since the last coaching session, and spoke positively about chunking tasks for Emma. One example of these tasks was giving Emma three top ticks to focus on (instead of 16) and gradually building these up. Chrissie highlighted that before implementing this chunking strategy she spoke with Emma (because Emma does not like to be different). Emma was positive regarding the use of the strategy and had since reported to Chrissie that she finds it easier to complete tasks with less top ticks to focus on. However, Chrissie did comment that she felt further progress could be made towards this goal. These discussions were noted in the 'Issue', 'Reality' and 'Goal' sections on the I-GROW framework. Based on our discussions, it was also agreed that there would be a second goal focused on improving Emma's independence as a learner. Various research-informed strategies to achieve these goals were discussed and noted in the 'Options' section. Chrissie decided to select three strategies to focus on and these were detailed in the 'Ways Forward' section. See Figure 23 for a full summary of the discussions and jointly completed I-GROW framework.

Figure 23

I-GROW framework for coaching session two



6.1.7 Observation Three

Three weeks later, I returned to the school for the final observation and coaching session. I observed Emma during an English lesson, where the learning objective involved writing a newspaper article. The following was noted from this observation:

- Chrissie asked the whole class what they had done using post it notes in their books the other day and what this was called. Another student said "metacognition" and this led to a discussion about what metacognition was (the idea of autonomy). Chrissie then reminded the students about different resources / things they could draw on other than "asking a friend" or "thinking positively".
- Chrissie asked Emma if she had her metacognition post it note in her book. Emma checked her book but did not have it.

- Chrissie asked students to carry out a kinaesthetic activity i.e. putting their finger on the part of the plan they should do next.
- For the front table (where Emma was sat), Chrissie modelled the task to the students ("now I have my three bullet points I can start writing. Give it a try for yourselves. When you have done it, put your hand up and I will come and have a look.") Emma drafted her ideas on a whiteboard and started writing.
- At times, Emma whispered out loud to herself what she wanted to write.
- Emma used a dictionary, word banks and discussed aspects of her work with a peer.
- With support from Chrissie, Emma was able to identify what a relative pronoun was in the text.

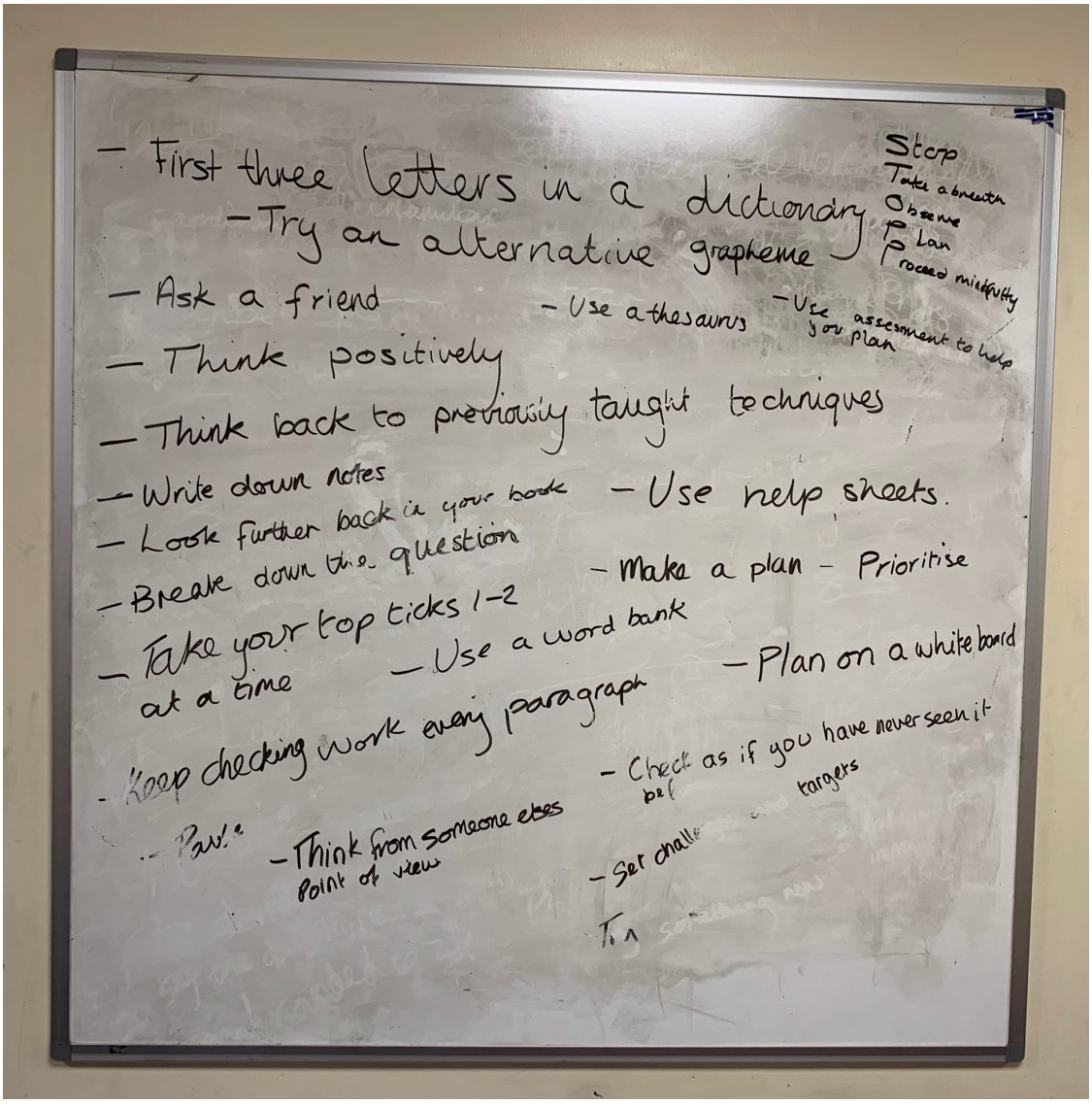
6.1.8 Coaching Session Three

After Chrissie read through the observation transcript, I asked whether she had any reflections. Chrissie detailed how it was positive to see Emma discussing work with her peers (rather than asking them for answers) and felt that Emma's independence as a learner had vastly improved.

Review of Previous Goal. When unpicking what had helped develop Emma's independence, Chrissie explained that following the previous coaching session, she had read up on metacognition using a Cambridge Assessment Metacognition resource. She had then implemented ideas within the class, which she felt had made a huge difference. Chrissie sensed it had built whole class resilience (as she then explained, the dynamics of the class make them rather "needy"). Chrissie also detailed how the class had been discussing autonomy and she felt these discussions had been beneficial for both the lower ability and higher ability students to help them extend their work. Following the whole class discussion, the students in the class thought of strategies they could use to support their own learning (see Figure 24)

Figure 24

Whole class metacognition strategies to support student learning



Strategies from the discussion were left displayed on the whiteboard for students to refer back to as needed. Chrissie explained how Emma was keen to contribute to the list of metacognition ideas. Her contributions were:

- Think back to previously taught techniques
- Break down the question
- Use a word bank

Chrissie also discussed how she had recently conducted a “what type of smart are you?” quiz with Emma. This was because Emma had been disheartened about her recent maths assessment results. Chrissie wondered aloud whether

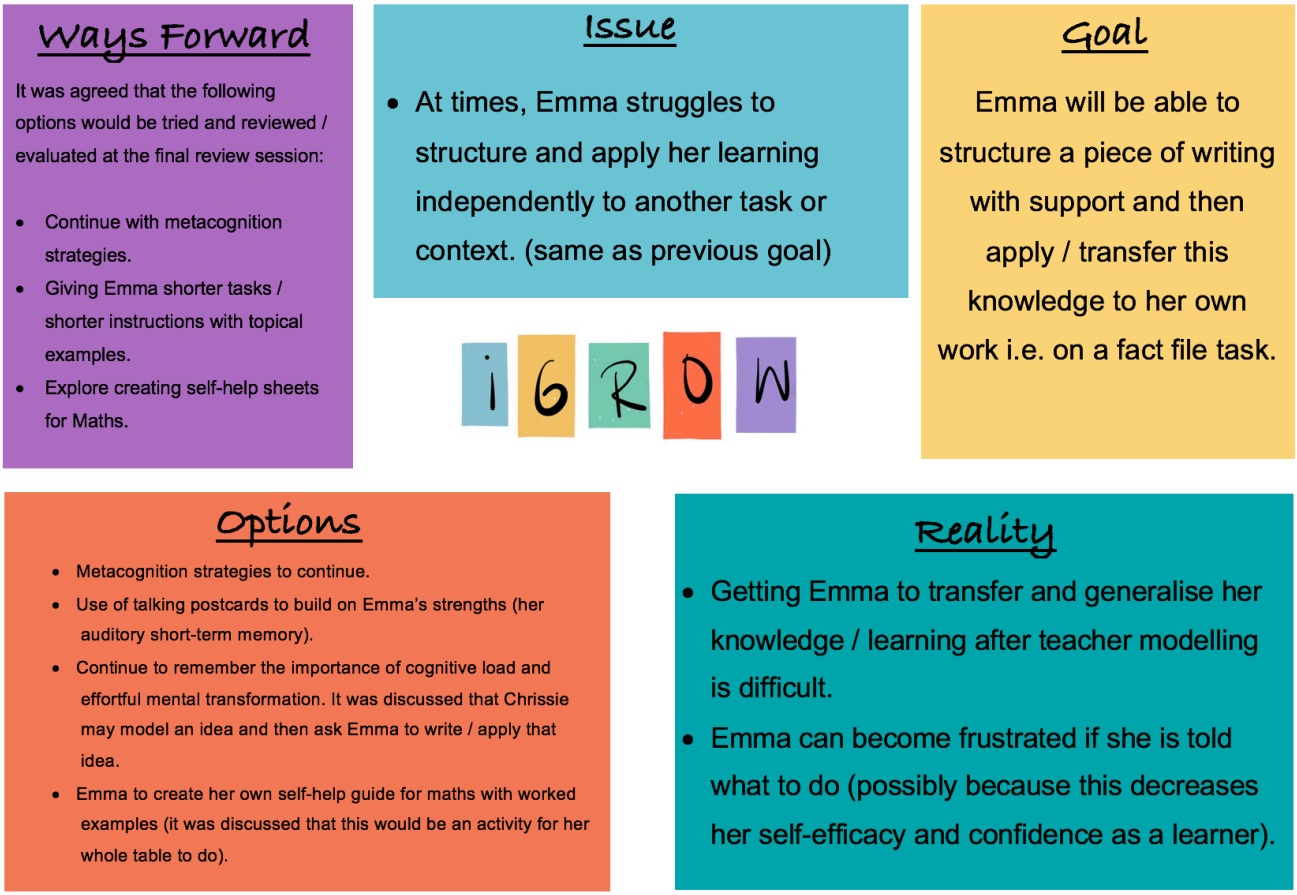
doing a similar task with the rest of the group would be beneficial. The potential benefits of using such strengths based approaches for learner self-esteem and self-efficacy were discussed.

I also drew Chrissie's attention to places in the observation transcript where she had used strategies to support working memory such as modelling the task. It was also highlighted to Chrissie how other students in the class had engaged in peer discussions i.e. one student asked another "where did you get your alliteration from?"

It was discussed that Chrissie had noted progress in relation to one of the previous goals (Emma's independence as a learner). The other goal (Emma structuring a piece of work with support and writing this independently) was thought to be on-going and it was therefore agreed that this would remain a focus. These discussions were captured in the 'Issue', 'Reality' and 'Goal' sections on the I-GROW framework. When discussing how Emma can struggle to structure a piece of writing independently, I showed Chrissie the Instructional Hierarchy (Haring et al., 1978). We discussed how generalising learning from teacher input to independent work requires Emma to draw on the higher level skills of generalisation and adaptation. As this is an area of difficulty for Emma, using a strengths based approach (building on her short term auditory memory strengths) was discussed and resources such as talking postcards were explored. We also considered how the results from the assessment work and my observations, suggest that Emma responds well to visual-spatial tasks. As such, it was explored whether modelling techniques may be helpful for Emma's learning. These strategies were noted in the 'Options' section. Chrissie then selected three strategies to focus on before the final coaching session, which were detailed in the 'Ways Forward' section. See Figure 25 for a full summary of the discussions and jointly completed I-GROW framework.

Figure 25

I-GROW framework for coaching session three



6.1.9 Final Review Session

One week later I returned to the school. Firstly the goal from coaching session three was reviewed, followed by a review of the whole coaching process.

Review of Goal From Coaching Session Three. The previous goal (Emma will be able to structure a piece of writing with support and then apply / transfer this knowledge to her own work i.e. on a fact file task) was reviewed. Chrissie commented how she felt Emma had met this goal and I unpicked this further. Chrissie explained how Emma did not know how to begin the task so Chrissie broke the task into chunks i.e. one part at a time and modelled these chunks. Emma was then able to complete the task and work independently for most of the morning. Chrissie explained that Emma chose to extend her learning

by creating her own animal (rather than following the teacher example) and chose to write her fact file about a bubble wrap turtle.

Chrissie reflected that by discussing the task with the whole-class, this did not single Emma out, and writing the initial paragraph together helped Emma to get started. I reflected back to Chrissie how her approach incorporated an awareness of cognitive load demands alongside elements of modelling, and that both elements had appeared to assist Emma's learning.

Review of Coaching Process. Chrissie reflected that she was confident with helping Emma in literacy, and the only challenge that remained was numeracy lessons (which had not been focused on during coaching due to a limited number of sessions). Chrissie explained how Emma's retention of numeracy learning is poor and that this is problematic in Year 6 due to maths problems drawing upon different areas e.g. using fractions to find money.

I discussed with Chrissie that many successful strategies I had observed her using could assist Emma with her numeracy learning. This included building on Emma's strengths by using visuals (such as help sheets) or kinaesthetic tasks (such as creating mind-maps or modelling tasks). This also included being mindful of cognitive load, using aspects of metacognition and applying principles from the Instructional Hierarchy (Haring et al., 1978).

In addition, the mathematical tests completed at school were discussed. Chrissie explained how Emma had been disheartened when she got 29 out of 40 (whilst aiming to get 30/40). I wondered aloud whether there were alternative ways to celebrate success i.e. not celebrating those who get full marks, but instead celebrating progress. Chrissie then commented how she thought she could develop classroom rewards for progress rather than attainment.

The goals set during the coaching contracting session in the 2019 Summer Term were reviewed and Chrissie felt that these had all been achieved as students had improved their independence, self-esteem and confidence. Chrissie also felt that her own understanding of working memory had improved throughout the process.

I drew Chrissie's attention to things which she had discussed in her initial interview i.e. breaking down tasks and noted how I hoped that the coaching process had enabled her to link theory with strategies she may have previously used. Chrissie was very positive about the coaching process and stated how much she had enjoyed it and found it helpful. During the coaching review session, Chrissie completed the post-coaching self-efficacy measure. She rated herself higher for each aspect of the self-efficacy scale in comparison to the pre-coaching measures.

Part Two - Cross Coaching Analyses

In this section, I will present a cross-case analysis of all coaching sessions. Firstly, I will present a summary of coaching using my field notes to illustrate the teacher strategies and discussion themes. Following this, I will evaluate the impact of coaching using self-efficacy measures, post coaching measures and a follow up online questionnaire.

6.2 Field Note Themes

Appendix 24 illustrates a visual map of the research-informed discussions from across all seven coaching sessions. In this chapter, Table 20 provides similar information about the teacher discussions, along with the theory base and subsequent strategies that were trialled by teachers.

Table 20

Research informed discussions from all coaching sessions

Discussion	Theory	Strategies Tried By Teachers
• Child struggles to develop their retention and fluency of skills. • Child struggles to adapt or generalise learnt skills.	Haring et al. (1978) Instructional Hierarchy	• Pre-teaching content • Starter activities to build fluency skills
Teacher wishes to develop student independence as a learner.	Flavell (1979) - metacognition Reuven Feuerstein's work	• Teachers modelling metacognition language and own thinking. • Using open questions. • Whole class strategies to encourage students to be reflective and discuss helpful strategies for their learning. • Getting students to use strengths with language to talk through tasks.
There is a link between working memory and other areas of SEN i.e. medical or sensory needs.	Henry (2001) and Alloway et al. (2009a) (Link between working memory and other SEN)	• Importance of learning / sensory breaks • Multi-modal resources to support with visual perception difficulties. • Practical activities to aid with recording work.

Discussion	Theory	Strategies Tried By Teachers
• The emotional impact of working memory difficulties. • Student experiences difficulties with processing speed and has a negative self-perception of themselves as a learner.	Evely & Gamin (2013) and Gathercole & Alloway (2007) (Classroom presentation of students with working memory difficulties)	• Check task understanding • Creative / practical tasks promote student engagement. • Provide extra thinking / processing time for students. • Provide opportunities for structured independence. • Positive feedback from adults. • Peers as 'memory buddies' • Resources available to whole class.
• Students struggle to retain information over time • Students struggle to manage large amounts of cognitive load	Baddeley (2010) Multi-Component Model of Working Memory Gathercole, Adams & Hitch (1994) (Visual to verbal shift over childhood) Chase et al. (2008) Strand et al. (2008) Osaka et al. (2007) (Different brain areas link to different memory functions) Research regarding working memory computer training programmes	• Using visuals to support visual to verbal shift • Using multiple modalities i.e.: o Talking with a peer o Highlighting text o Modelling strategies o Using practical tasks e.g. acting. • Use of external memory aids i.e: o Flashcards o Literacy pyramids o Word Banks o Physical manipulatives i.e. Numicon o Speech to text software • Reducing cognitive load by: o Keeping instructions short o Using temporal language i.e. "first", "then" o Adults scribing for the child where needed o Dictaphones / Talking Postcards o Breaking tasks / instructions into chunks o Visuals i.e. checklists / prompts o Structured planning sheets for tasks o Numbering paragraphs or steps
Students struggle with longer-term retention (exacerbated by factors such as external distractions or poor school attendance).	Ebbinghaus Forgetting Curve (Murre & Dros, 2015)	• Using effortful mental transformation (i.e. 'doing' something with the information) to prevent decay. E.g. discussing with a peer what the teacher has just said. • Spacing review of content (pre-teaching / recapping work)

The strategies trialled by teachers throughout the coaching process were a mixture of compensatory strategies, external memory aids and strategies to assist memory recall.

Baddeley's (2010) Multi-Component Model of Working Memory was relevant to, and discussed with all seven teachers who undertook coaching. Other discussions and strategies were specific to each teacher and their individual pupil, although the emotional impact of working memory difficulties and developing learner independence and awareness were prominent themes. These discussions occurred with six out of the seven teachers.

Long-term retention and skill fluency were also key themes for most of the teachers and the Instructional Hierarchy (Haring et al., 1978) and the Ebbinghaus Forgetting Curve (Murre & Dros, 2015) were discussed with five out of the seven teachers. The link between working memory and other areas of SEN was only raised as a topic of discussion by the two teachers who taught in the provision, and not by the five mainstream teachers.

6.3 Pre-Coaching and Post-Coaching Self-Efficacy Change

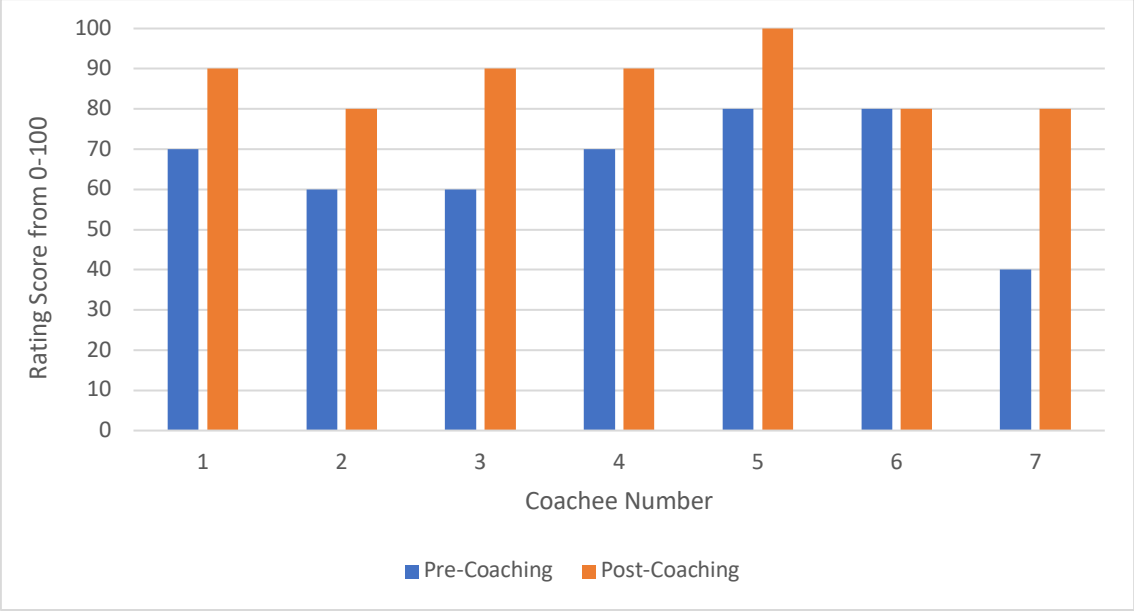
Each coachee was asked to rate themselves against four statements to examine their confidence and self-efficacy. I asked the coachee to rate themselves firstly during the coaching contracting session (pre-coaching) and secondly during the review session (post-coaching).

6.3.1 Belief in own ability to know what difficulties Child A (the case pupil) has with their learning

I provided each coachee with the statement "*I know what kinds of difficulties Child A has with their learning*". I asked them to rate where they would place themselves on a scale of 0 (I do not) to 100 (highly certain I do). Responses for each coachee are detailed in Figure 26.

Figure 26

Pre-coaching and post-coaching responses from coachees for statement one.



Six coachees rated themselves higher on the post-coaching measure than the pre-coaching measure. This suggests that following the coaching sessions, most felt they had a better understanding of the difficulties that the case pupil faced within their classroom.

6.3.2 Belief in own ability to know what teaching strategies to use with Child A (the case pupil)

The next statement "*I know what teaching strategies to use with Child A*" asked each coachee to rate where they would place themselves on a scale of 0 (I do not) to 100 (highly certain I do). Responses for each coachee are detailed in Figure 27.

Figure 27

Pre-coaching and post-coaching responses from coachees for statement two

All seven coachees rated themselves higher on the post-coaching measure. This suggests that following coaching, all coachees felt more confident that they knew what teaching strategies to use with the case pupil in their classroom.

6.3.3 Belief in own ability to implement appropriate teaching strategies for Child A (the case pupil)

The third statement "*I can implement appropriate teaching strategies for Child A*" asked each coachee to rate where they would place themselves on a scale of 0 (I cannot) to 100 (highly certain I can). Responses for each coachee are detailed in Figure 28.

Figure 28

Pre-coaching and post-coaching responses from coachees for statement three

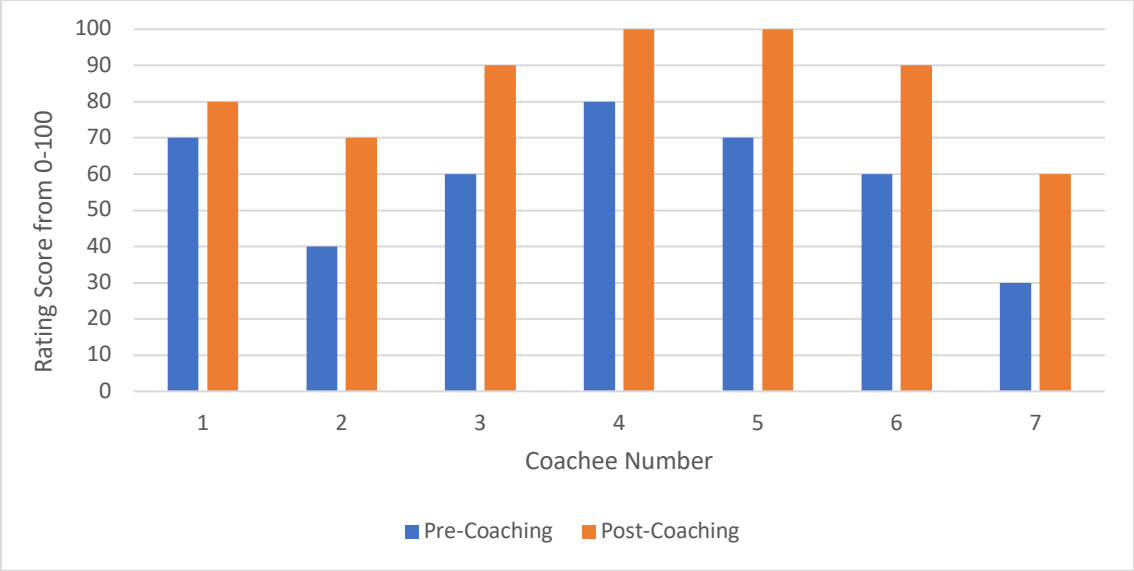
All seven coachees rated themselves higher on the post-coaching measure. This suggests that following coaching, coachees felt more confident that they could implement appropriate teaching strategies for the case pupil in their classroom.

6.3.4 Belief in own ability to identify working memory difficulties in future

The final statement "*I can identify another child who may have working memory difficulties in the future*" asked each coachee to rate where they would place themselves on a scale of 0 (I cannot) to 100 (highly certain I can). Responses for each coachee are detailed in Figure 29.

Figure 29

Pre-coaching and post-coaching responses from coachees for statement four



All seven coachees rated themselves higher on the post-coaching measure. This suggests that following coaching, all coachees felt more confident that they could identify another child who had working memory difficulties in future. Table 21 illustrates the overall group change for each statement. No statistical tests were conducted on this data due to the small sample.

Table 21

Overall group change for each statement assessing self-efficacy

Statement	Mean Score Pre-Coaching (out of 100)	SD Pre-Coaching	Mean Score Post-Coaching (out of 100)	SD Post-Coaching	Mean Change
I know what kinds of difficulties Child A has with their learning	65.71	13.97	87.14	7.56	21.43
I know what teaching strategies to use with Child A	67.14	11.13	88.57	3.78	21.43
I can implement appropriate teaching strategies for Child A	64.29	13.97	91.43	3.78	27.14
I can identify another child who may have working memory difficulties in the future	58.57	17.73	84.29	15.12	25.71

The mean scores indicate that across all teachers, there was an increase of around 20 points (on a 100 point rating scale) between the pre-coaching and post-coaching self-efficacy measure. The largest change was regarding teacher confidence to implement appropriate strategies for Child A. This suggests that after undertaking coaching sessions, teachers felt confident to implement strategies with their case pupil.

Teachers were slightly less confident generalising their knowledge and identifying another child with working memory difficulties in the future. It is important to note that the pre-coaching score for this statement had the lowest rating (58.57). One reason for this may because teachers did not have an accurate or research-

informed understanding of working memory prior to coaching (as discussed in Phase One), which lowered their self-efficacy regarding the identification of working memory difficulties.

Standard deviations were lower across all post-coaching statements, indicating that there was less variation amongst post-coaching teacher ratings, than pre-coaching teacher ratings.

In summary, the self-efficacy pre-coaching and post-coaching measures suggest that:

- Most coachees experienced greater awareness of the case pupil's difficulties.
- All coachees felt more confident knowing what strategies were helpful for their case pupil and were confident to implement these within the classroom.
- Following coaching, all coachees were more confident to identify other students with working memory difficulties in the future. However, teachers rated themselves slightly lower on this statement than other statements.

6.4 Post-Coaching Questionnaire

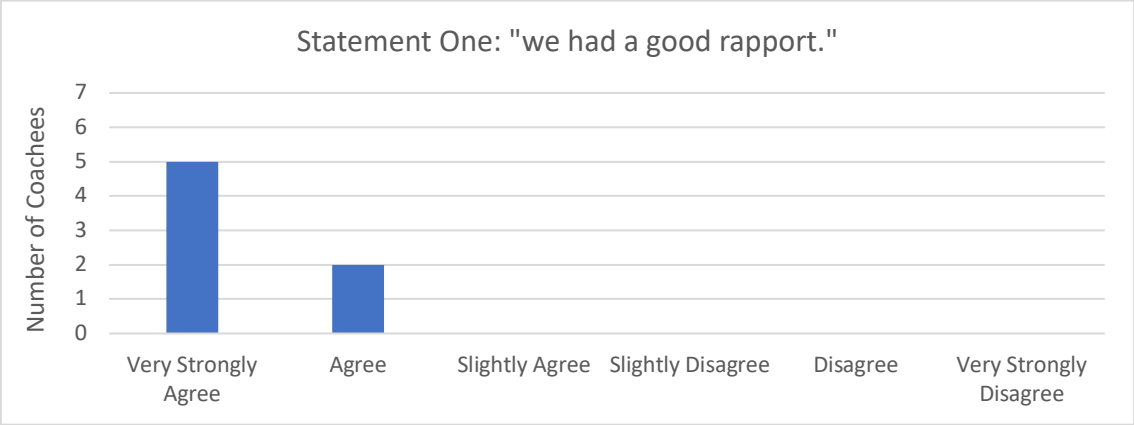
Following the coaching sessions, each coachee completed a post-coaching questionnaire to explore their experience of coaching.

6.4.1. How well the coach and coachee worked together (questionnaire part one)

Each coachee rated four statements on a six point Likert scale to assess how well they felt they worked with the coach. Figure 30 illustrates the response to the statement "*we had a good rapport.*"

Figure 30

Graph illustrating the responses to statement one



All seven coachees stated that they felt they had a good relationship with the coach. Five of the seven coachees stated that they "very strongly agree" that there was a good rapport whilst two coachees stated that they "agree" there was a good rapport. No coachees indicated that they disagreed they had a good rapport with the coach.

Figure 31 shows the responses to the statement "*we agreed the goals I was working towards*."

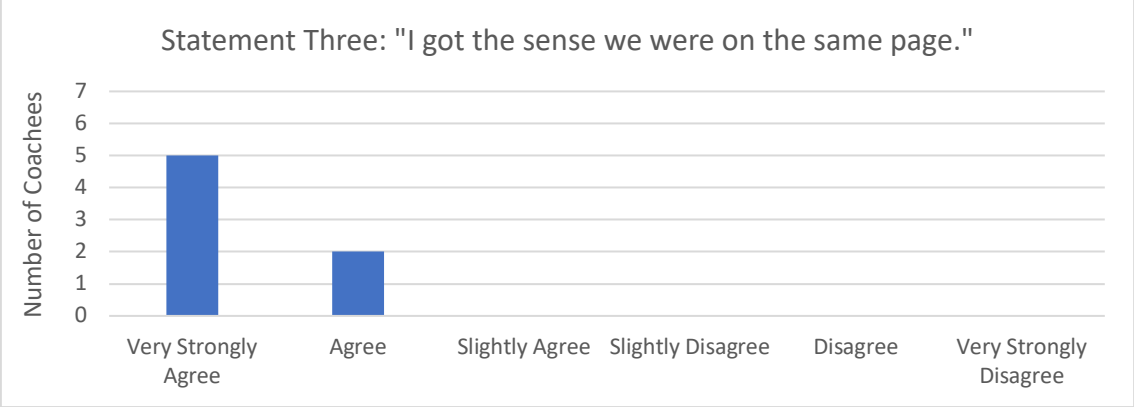
Figure 31

Graph illustrating the responses to statement two

The responses to statement two were positive. All seven coachees stated that they very strongly agreed the goals worked on were co-constructed. Figure 32 illustrates coachee responses to the third statement "*I got the sense we were on the same page*."

Figure 32

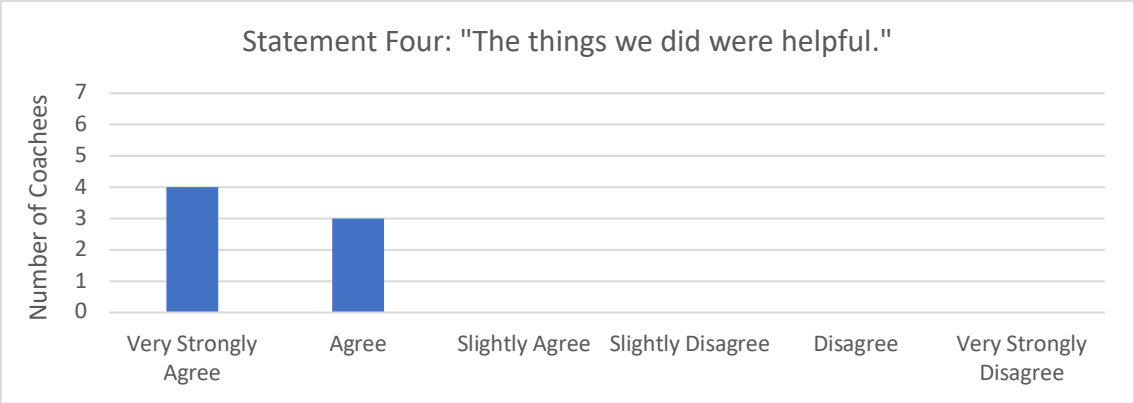
Graph illustrating the responses to statement three



All seven coachees stated that they felt they were on the same page as the coach. Five stated that they "very strongly agree" they were on the same page whilst two stated that they "agree" they were on the same page. None of the coachees indicated that they disagreed. Figure 33 illustrates the responses to the final statement assessing how well the coach and coachee worked together.

Figure 33

Graph illustrating the responses to statement four



All seven coachees stated that they felt the things covered in coaching were helpful. Four stated that they "very strongly agree" it was helpful, and three stated that they "agree" it was helpful.

Three coachees added comments in the optional qualitative section and these are detailed in full in Appendix 25. These comments made reference to a positive questioning style and a "very welcoming and non-judgemental environment that allowed for a productive and positive conversation" (Caroline). One coachee also noted the setting of achievable targets, explaining:

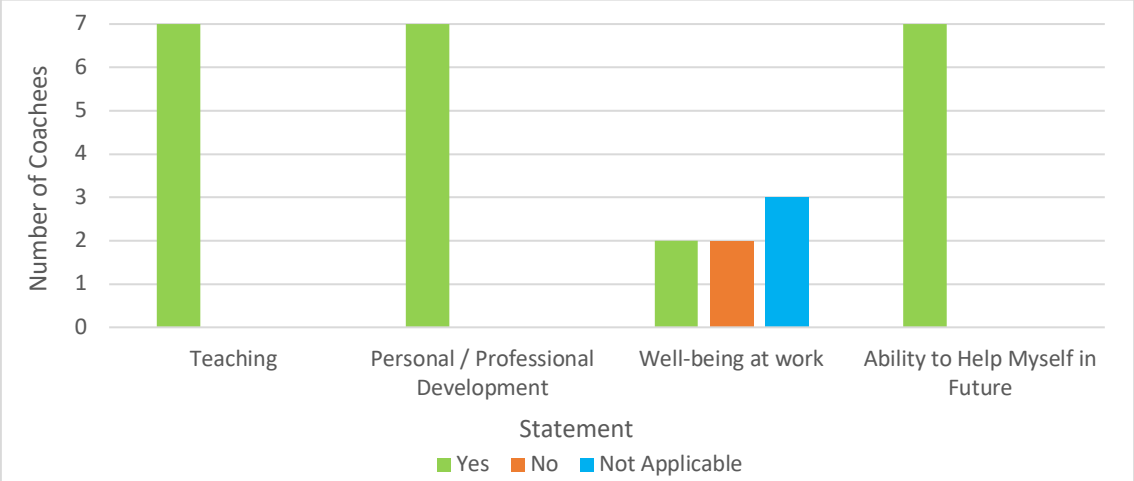
> I felt we worked well together and were on the same page on the goals to set and how to reach them. I also felt that you worked intuitively to gauge my teaching style and suggest methods and ideas which worked well with that. You had a great understanding of what was manageable and we set targets in accordance with this. I never felt that what was set was unachievable but there was always something constructive to develop (Chrissie).

6.4.2. The impact of the coaching (questionnaire part two)

Each coachee was asked to rate their responses (yes, no or not applicable) to four statements which assessed the impact of the coaching on different areas of their development. Figure 34 illustrates the coachee's responses.

Figure 34

Graph illustrating coachee responses to the impact of the coaching on different areas of development.



All seven coachees felt that coaching had a positive impact on their teaching, personal / professional development and their ability to help themselves in the future. The responses for whether the coaching had an impact on their well-being at work, however, were mixed. Of the responses, two coachees agreed that coaching did have a positive impact on their well-being, two disagreed that coaching had a positive impact on their well-being and three did not think it was applicable. These results therefore suggest that many teachers regarded the coaching as positive for their teaching role but did not perceive or regard coaching as helpful for their well-being.

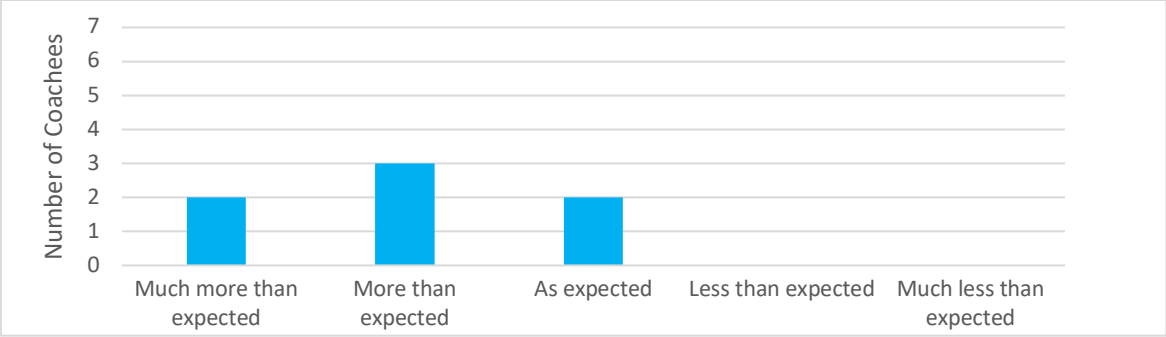
Associated with these ratings were some qualitative comments and these are detailed in full in Appendix 25. Some coachees such as Zoe noted how coaching "has had a very positive impact on my professional development". Others made positive references to the opportunities to reflect and look in-depth at a case, stating that the "opportunity to reflect upon our own practice was beneficial" (Caroline).

6.4.3. Changes in teachers' understanding and teaching practices as a result of coaching (questionnaire parts three and five)

Each coachee then rated four statements on a five point Likert scale, designed to assess changes in their understanding of working memory difficulties and changes in their teaching practices. Figure 35 illustrates the response to the first statement "*my understanding of children's working memory has improved since undertaking coaching.*"

Figure 35

Graph illustrating coachee responses about understanding of working memory



All coachees stated their understanding of working memory had improved following coaching. Five coachees stated that their understanding improved "more than expected" or "much more than expected". The other two coachees stated that their knowledge and understanding improved "as expected."

Six coachees added comments in the optional qualitative section regarding the new knowledge they had gained through coaching. Some coachees stated that their knowledge had improved generally, whilst other coachees such as Zoe and Chrissie, made reference to specific aspects of knowledge they had gained such as the phonological loop or metacognition. There is a theme across most coachees suggesting that they have enhanced their knowledge of working memory (highlighted in yellow). Knowledge of teaching adaptations (highlighted in blue) include both "whole class approaches", and "personalised" approaches. Gemma, in particular, makes reference to her teaching adaptations aiming to improve retention of learning. The full comments are detailed below in Table 22.

Table 22

Qualitative comments detailing the working memory knowledge and understanding teachers gained from undertaking coaching

Key:

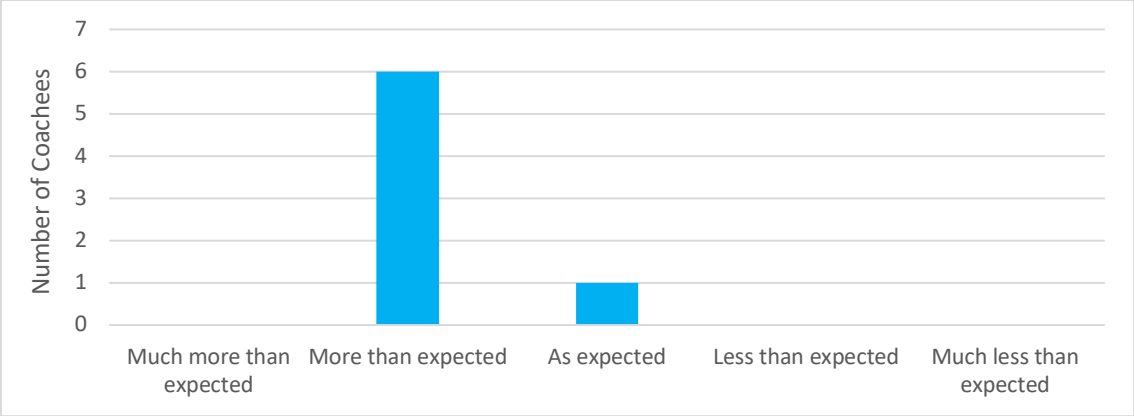
Knowledge of working memory, teaching adaptations, specific knowledge gained

Coachee*	Comment
Zoe	"*I have learned a lot more about the aspects of working memory e.g. phonological loop and auditory and visual / spatial."*
Chrissie	"*I have gained a better understanding of whole class approaches I can take to help with individual pupil needs. I have also learned about metacognition and how a range of techniques in this approach have a marked impact on all pupils."*
Caroline	"*Better understanding of working memory on the whole. Adaptation of tasks in order to support working memory difficulties*."
Gemma	"*Identified times when the children find receiving and processing information challenging. Use of repetitive methods to help children retain some info e.g. daily flashcards*."
Rachel	"*At the beginning I had no idea about working memory. Now I feel like I understand it and feel armed with practical and personalised ways to improve children's everyday learning experiences*."
Matthew	"*The different ways in which children learn. Ways of teaching that might help those with working memory difficulties to learn more effectively*."

Figure 36 illustrates the response to the second statement "*my ability to identify children with working memory difficulties has improved since undertaking coaching.*"

Figure 36

Graph illustrating coachee responses about identifying students with working memory difficulties.



All coachees rated that their ability to identify children with working memory difficulties improved following coaching. Six coachees rated that this improvement was “more than expected”, whilst one rated that this improvement was “as expected.”

Six coachees also added comments to the qualitative section and these are detailed below in Table 23. Chrissie, Zoe and Gemma spoke positively about how their improved awareness of working memory has led to improved identification. However, Zoe referred specifically to her improved ability to “spot some symptoms”, placing a medical and diagnostic lens on this identification. Many coachees detailed the observable behaviours they may witness within a classroom including students “being unable to retain information” (Zoe) or how working memory can “affect children’s ability to independently access their learning” (Caroline). These extracts portray similar notions to the ‘Feelings, Emotions, Affect and Independence’ theme and the ‘Difficulties with retaining and recalling learnt information’ subtheme identified in Phase One of the research. Chrissie and Caroline also note how identification can be affected by students using “coping strategies” (highlighted in blue).

Table 23

Qualitative comments detailing the improvements in coachee identification of working memory difficulties since undertaking coaching.

Key:

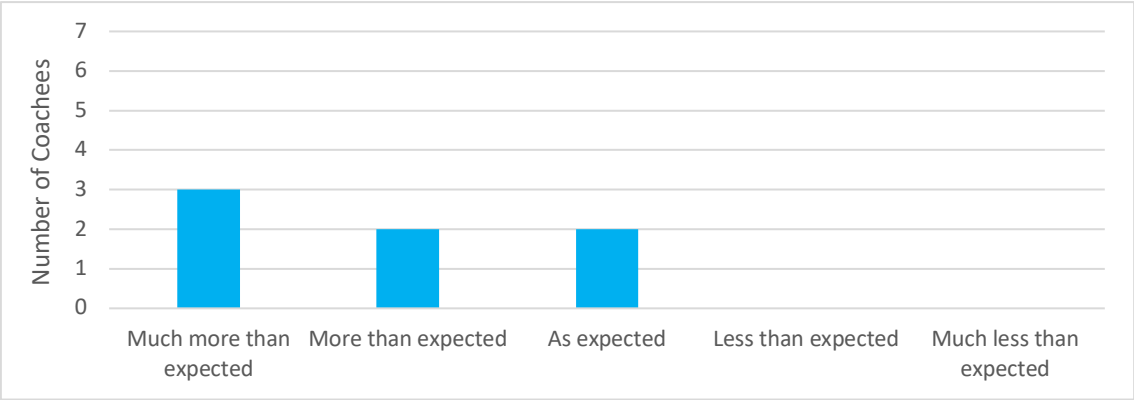
Classroom behaviours, improved identification, coping strategies, diagnostic lens

Coachee*	Comment
Zoe	*"I can spot some symptoms such as losing track mid-sentence or being unable to retain information."*
Chrissie	"*I have gained more of an understanding of how to identify pupils with working memory struggles and how to help them through tweaks and adjustments to my teaching style. I have learned that there are a range of ways that working memory can affect pupils and also the ways that they often can mask their struggles."*
Caroline	"*Understanding of how working memory can affect children's ability to independently access their learning. Also how 'coping strategies' can manifest and not necessarily point to abilities."*
Gemma	"*Would recognise it more in whole class situations. Training helped identify need for more observation time of children and letting others teach so I can observe and see their understanding / best methods to retain info."*
Rachel	"*I hadn't considered about working memory before. Now I can use ideas from the coaching with benefit to all children in our (SEN) classes.*"
Matthew	"*That working memory is not necessarily linked to issues of remembering things in the long term*."

Figure 37 illustrates the response to the third statement "*my ability to adapt my teaching to take account of working memory approaches has improved since undertaking coaching."*

Figure 37

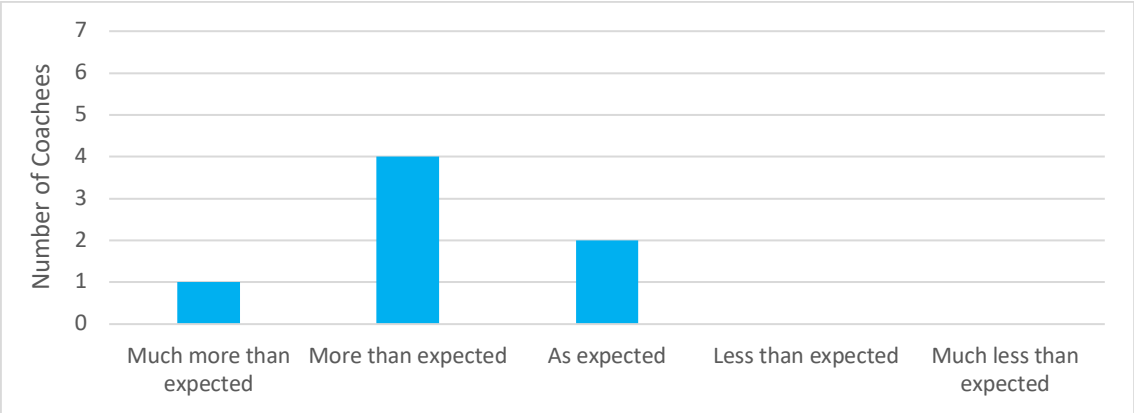
Graph illustrating coachee responses about adapting their teaching to take account of working memory difficulties



All coachees stated that their ability to adapt their own teaching to take working memory difficulties into account had improved since undertaking coaching. Five coachees rated that this improvement was "more than expected" or "much more than expected", whilst two rated that this improvement was "as expected." Figure 38 illustrates the coachee responses to the final statement "*taking part in coaching has changed some aspects of my teaching practices*."

Figure 38

Graph illustrating coachee responses to changed teaching practices



All coachees stated that their teaching practices had changed following coaching. Five rated that this change was either “more than expected” or “much more than expected.” Two rated that this change was “as expected.”

Six coachees added qualitative comments. These comments indicated that raised awareness of working memory had a positive impact on their teaching. For Zoe, Rachel and Chrissie, they detailed how this raised awareness has a positive impact for their planning and the resources they use (highlighted in grey). Others also detailed the specific multi-modal teaching adaptations or resources they use: visual (highlighted in yellow), auditory (red) and practical / kinaesthetic (pink).

For some coachees such as Chrissie and Matthew, engaging in coaching made them aware of managing cognitive load. Chrissie details how she considers “the number of instructions and stages given in a task”, whilst Matthew provides a “more broken-down approach to learning.” Some coachees such as Caroline however, highlighted how the coaching process was more about “re-prioritising certain strategies” and ensuring these were at the forefront of their daily practice. The full comments are detailed below in Table 24.

Table 24

Qualitative comments detailing the changes in teaching

Key:

Raised awareness, visual teaching adaptations, auditory adaptations, practical / kinaesthetic adaptations, managing cognitive load, re-prioritising strategies, preparation for secondary school

Coachee*	Comment
Zoe	*"I have been able to spot issues and work out ways to support the child in and out of class. Rather than just giving them some kind of scaffold because they are low ability, I'm thinking specifically about their memory and what will help to build on it, what little bits we can do before a lesson, what little bits we can do in the classroom that will help.* *I'm spending more time probably planning for those children which is obviously having an impact because of the progress shown. I'm considering all of those different areas like the visual, the phonological loop and even today thinking about how I could number things next time so that makes more sense. I guess I am more confident when planning for children with working memory issues and now think more about them. I would plan for a child who speaks English as a second language, so I should plan for every need. If I have got someone who has a poor working memory then I need to plan for that as well."*
Chrissie	"*I have made a range of adjustments to my teaching style and also to the way I approach setting and managing work and tasks in the classroom. I consciously consider the impact of my instructions and tasks on pupils and how they will process the information given.* *In all my lessons, I consider the number of instructions and stages given in a task. I also consider how much prior knowledge they will have to draw on and how they can access this knowledge easily. I consider what the main focus of the lesson is and therefore what manipulatives and prompts can be given to help the pupil achieve the main focus. I have also been working on metacognition skills with the class and giving all of them more ways to support and develop their own learning."*
Caroline	"*Re-prioritising certain strategies (e.g. word banks, visual prompts, kinaesthetic tasks).*"
Gemma	"*We use a range of auditory, kinaesthetic and visual resources as part of our daily routines. Repetition of instructions and use of different environments to carry out the same task in order to identify factors which may affect retaining information."*
Rachel	"*The coaching sessions were a great opportunity to reflect on good practice. The questioning by Kiera directed my thoughts to how best get children to achieve their goals, therefore making my ideas and planning far more personalised to them. This has been really helpful. I have used more speaking and listening / drama / Makaton signing / videoing and reflecting with students prior to writing = better outcomes. Using a Dictaphone and other recording devices, prompting better vocab using post it notes and reassurance that it is fine to scribe / provide word banks etc. because it benefits memory. I like how Kiera linked it to metacognition and gave me more ideas for how to develop some children in preparation for secondary school in the last session, giving me ideas to develop further.*"
Matthew	"*Providing those with working memory issues with a more broken-down approach to learning so that there are not so many things to be thinking about during lessons. A more guided approach to tasks with multiple steps. Visual prompts at the front of classroom. Modelling tasks and good practice.*"

6.4.4. Whether coaching would be recommended to others (questionnaire part four)

Each coachee was asked to rate their responses (yes, no or unsure) for whether they would recommend coaching for other teachers. All seven teachers stated that they would recommend coaching to other teachers who may have children with working memory difficulties in their class.

Six coachees added comments to the optional qualitative section. Some teachers such as Zoe and Chrissie, noted the value of having another professional's perspective (highlighted in blue). However, Zoe's comment "having someone who is more of an expert than I am" illustrates how she perceived this in a hierarchical and expert manner.

Most coachees also appeared to value the reflection time that coaching provided (highlighted in yellow). Some such as Zoe and Gemma noted how they "don't normally get this time" or how reflection "may not usually be the priority." Some such as Rachel acknowledged the time demands and noted how coaching was "hard to squeeze in" but felt that the benefits outweighed the costs and "it was worth it." Others also directly acknowledged the benefits for students (highlighted in pink). The full comments are detailed overleaf in Table 25.

Table 25

Qualitative comments detailing whether coaching would be recommended to others

Key:

Value of another professionals' perspective, expert view, valued reflection time, time demands of coaching, benefits for students, better understanding.

Coachee*	Comment
Zoe	*"It's been really helpful to have this time to think about everything we have been doing and be more in depth with my reflections of different lessons. You don't normally get this time and it's really handy to pick it apart. And it's handy to have someone else who is like almost impartial because you are not judging my teaching, you are judging the things that we are doing which are specific to the working memory. So it's been really nice having that time and having someone who is more of an expert than I am in certain areas and working together about what would work and what wouldn't work. Yeah it's been great, I would definitely recommend it."*
Chrissie	*"I think that the coaching was incredibly helpful to see my teaching from another perspective. I am sure it would be useful for any teacher who would like to develop their practice. Particularly, as I had little understanding of working memory and how it can impact a range of pupils, not only those with SEND needs."*
Caroline	"*Any opportunity to reflect on our own practice and therefore improve our understanding is always beneficial, as it will subsequently have a positive impact on our children.*"
Gemma	"*Gives the time to reflect and observe everyday practices within the classroom which may not usually be the priority.*"
Rachel	"*It was helpful in terms of improving children's learning / my teaching / enabling reflection about good practice / better planning etc. Yes, it's hard to squeeze in but it was worth it.*"
Matthew	*"[coaching] provides teachers with a greater understanding of what working memory is and the different issues that children may encounter when it comes to learning.*"

In summary, the results from the post-coaching questionnaire suggest that:

- Coachees were positive about the working relationship with the coach including the rapport built and felt they were working together on the same goals.

- Coachees were positive about the impact of the coaching on many areas of their development, although some did not perceive that coaching had a positive impact for teacher well-being.

- Coachees stated that they felt their understanding of working memory and ability to identify students with difficulties had improved following coaching. This raised awareness appeared to have a positive impact on teaching practices, with teachers noting how they often took working memory difficulties into account when planning tasks or activities in the classroom.

- Coachees stated that although coaching is time-demanding, they would recommend it to other teachers because they valued the reflection time and it allowed them to prioritise their professional learning and development.

6.5 Online Follow Up Questionnaire

Between two and six months after the final coaching session, coachees were asked to complete an online follow-up questionnaire to explore the longer-term impact of coaching. Five of the seven teachers responded.

6.5.1. The impact of coaching

Each coachee was asked to rate on a three point Likert scale (No, A Little, A Lot) whether coaching had a positive impact on their personal and professional development. All five teachers stated that taking part in coaching had a positive impact on their personal and professional development. Three of the five teachers stated that it had a large impact and two stated that it had a small impact.

6.5.2. Relevance of coaching sessions to current teaching practice

Each coachee was asked to rate either “yes” or “no” for whether coaching discussions were relevant to current teaching practice. All five teachers rated that coaching discussions were still relevant to current teaching practice. When asked to briefly detail which discussions were most relevant or most useful, comments included knowledge of “what working memory is”, “teaching strategies” and “resources.” One teacher specifically made reference to using “Dictaphones, videos and word banks on post it notes.”

6.5.3. Current use of knowledge gained through coaching

Each coachee was asked to rate either “yes” or “no” for whether they were currently using knowledge gained through coaching in their planning or teaching. All five teachers stated that they were using knowledge about working memory gained from coaching in their planning or teaching. When asked to briefly detail the knowledge they were using, comments included giving “careful thought about how I give instructions” alongside using “a wide range of aids” such as “visuals” and “practical tasks.” Some teachers stated that they used their knowledge in

their planning to “help pupils with working memory difficulties to access the learning more easily” and “use the knowledge gained to plan for the whole class.”

6.5.4. Sharing good practice

Each coachee was asked to rate either “yes” or “no” for whether they had shared any knowledge gained through coaching with other colleagues. Three of the five teachers stated that they had shared knowledge with other colleagues. For some teachers, this involved “sharing strategies with TAs in my class” including “what working memory is.” Two of the five teachers stated that they had not been able to share knowledge with colleagues. One teacher commented that a barrier for this was because they “haven’t managed to get time in staff meetings for this yet but will keep asking.”

6.5.5. Confidence regarding identification of children with working memory difficulties

Each coachee was asked to rate either “yes” or “no” for whether they felt confident to identify other children who may have working memory difficulties. All five teachers stated that following coaching, they felt confident to identify other children who may have working memory difficulties.

6.5.6. Recommending coaching to other colleagues

Each coachee was asked to rate either “yes” or “no” for whether they would recommend coaching to other colleagues. All five teachers stated that they would recommend coaching to other colleagues as an intervention and learning opportunity.

6.5.7. Final reflections on taking part in the research

Each coachee was given the option to include any final reflections they had from taking part in the research. The three coachees who responded all spoke positively about "having the time to reflect" (highlighted in blue). This is of particular significance given the day to day competing pressures that many coachees face (highlighted in yellow). The comment from one coachee about "implement[ing] strategies that I had, at times, forgotten about" also illustrates that some coachees may already have strategies they could use, but coaching has helped to unlock these through discussions and reflection. Table 26 illustrates the responses in full:

Table 26

Qualitative comments detailing final reflections from taking part in the research

Key:

Time for reflection, competing pressures faced by teachers, coaching can unlock strategies.

Comment
"*Overall just having the time to reflect on a wide range of teaching strategies and my practice has meant that I've been able to remember and implement strategies that I had, at times, forgotten about.*"
"The process allowed me time to observe and reflect on what happens in the classroom, which is something that often we do not take time to do in the everyday busy environment."
"*It was so helpful to be able to reflect on the best approach for individuals through Kiera's skilled questioning and structure*."

In summary, the results from the follow-up online questionnaire suggest that:

- All teachers felt that coaching had a positive impact on their personal and professional development

- All teachers stated that coaching discussions were still relevant to their classroom practice, and they continued to use strategies that had been discussed. This included to inform their planning.

- Most teachers shared their knowledge with other colleagues. All would recommend coaching to another colleague.

- All teachers stated that following coaching, they felt confident to identify other children who may have working memory difficulties.

- Teachers valued the reflection time that coaching provided, particularly given the competing pressures faced in their everyday role.

6.6 Changes in Working Memory Concepts

Following coaching, the teachers were asked the same qualitative question as they were asked in their initial interview: “can you describe what you think the term *working memory* means in a few sentences?” Chapter Four details the pre-coaching responses given during the initial interview. In this chapter, I mapped each teachers’ post-coaching understanding of working memory onto Gathercole and Alloway’s (2004) research based concept of working memory: “the ability to hold and manipulate information in the mind for a short period of time” (p.2). Table 27 illustrates the teachers’ change in understanding from pre-coaching responses to post-coaching responses.

Table 27

Teachers’ understanding of working memory in relation to the current research based concept of working memory from the literature

	Definition was unconnected to the current research based concept of working memory	**Definition was slightly connected to the current research based concept of working memory**	**Definition was closely connected to the current research based concept of working memory**
Pre-Coaching	Rachel Gemma Matthew Jamie	Caroline Zoe	Chrissie
Post-Coaching		Jamie Zoe	Gemma Rachel Chrissie Caroline Matthew

Prior to coaching, four teachers provided definitions that were unconnected to the current research based concept of working memory. For example, Jamie’s pre-coaching construct of working memory focused on the ability to process prior knowledge:

> I would see it as that ability to take up on something that is not necessarily a new experience but take up on something that has been supplied to them and then process that and use that in whatever way they need to (page 9, line 270).

Following coaching, his definition was slightly connected to the definition provided by Gathercole and Alloway (2004), as he discusses breaking down tasks so that the student is not "overwhelmed or overloaded" suggesting that he recognises the importance of cognitive load:

> It is about that compartmentalising or like breaking down / chunking of the task in order to allow full focus to be dedicated to one area at a time. Rather than having that kind of overwhelming or overload…that impossibility of being able to keep all those balls in the air if you are juggling them (Jamie).

Gemma, Rachel and Matthew's pre-coaching definitions were also unconnected to the current research based concept of working memory. Gemma's pre-coaching definition detailed how she perceived working memory as "based on sociology":

> based on sociology and different parts of the mind and different people working in different ways... So some people are kinaesthetic learners, some people are visual learners and it is how they best retain the information. So some people retain it just from viewing it, some people have to see it to retain it, some people have to do it to retain it (page 7, line 215).

Following coaching however, her definition is closely connected to the current research based concept of working memory as she refers to taking in and processing information : "I would say it is their ability to take in the information, process the information and complete the task using that information that they have been given."

Similarly, Rachel's pre-coaching constructs of working memory were unconnected to the current research based concept. She initially made links to her son who has dyslexia and her mother in law who had dementia. Her post-coaching definition, however, is closely connected to the current research based

concept as she details the storage demands involved as students hold information “in their heads”:

> Working memory is quite different in all the children... it is them not being able to hold the instruction or auditory things in their heads. Or some children can do that and it is not being able to hold visuals in their head compared to others (Rachel).

Matthew’s pre-coaching definition suggested that his construct of working memory was centred around retention and applying learnt knowledge to tasks: “the ability to sort of retain information over a medium to long period of time…and be able to recall what they [the students] need to use” (page 5, line 142). Following coaching, however, Matthew’s post-coaching definition is closely connected to the current research based concept defined by Gathercole and Alloway (2004). Matthew’s extract illustrates how he perceives working memory as linked to processing ‘there and then in the moment’:

> When someone has to process different instructions at the same time or a variety of information at the same time, not so much over a long period of time but using it and applying it there and then in the moment (Matthew).

Two other teachers, Caroline and Zoe, provided pre-coaching definitions that were slightly connected to the definition provided by Gathercole and Alloway (2004). Zoe detailed how working memory was “like the day to day memory… things you are using as you are going along rather than things you have to draw on from ages ago” (page 6, line 193). Her post-coaching definition suggested that she still regarded working memory as something students “draw on in the moment” but her links to embedding in longer-term memory was only slightly connected to the current research based concept: “All the stuff that you draw on in the moment that will help you embed it into your short-term and then your long-term I guess.”

Similarly to Zoe, Caroline’s pre-coaching definition was slightly connected to the current research based concept outlined by Gathercole and Alloway (2004). Caroline initially provided the analogy of a shelf and explained how “if you give

someone too much, whatever you do at the beginning drops off" (page 9, line 300)." In her post-coaching definition however, she refers to students remembering the "load" placed on them and "processing" this, which is closely connected with the definition provided by Gathercole and Alloway (2004): "the load that you are putting onto somebody and what they might need to be able to remember and use and process. So actually it being more about processing and a process rather than just a thing."

Chrissie's pre-coaching definition illustrated the importance of holding instructions and processing them, which was strongly connected to the current research based concept.

> remembering a series of key details to be able to put into their learning… So one thing they might be able to remember. But when you say this and this and this, that's too much. They [the students] can't do that (page 7, line 202).

Her post-coaching definition also makes reference to holding and processing information and therefore remains closely connected to the definition provided by Gathercole and Alloway (2004): "I would say working memory is how a child receives and processes a task or series of tasks."

In summary, these extracts illustrate how for most teachers, their understanding of working memory has developed through taking part in the coaching. For some teachers such as Rachel, Gemma and Matthew, there was a large development in their understanding. Whilst for other teachers, such as Jamie and Caroline, this development was not as large but present nonetheless.

The key findings in relation to research question five are:

- Teachers reported that their understanding of working memory and ability to identify students with working memory difficulties improved either more or much more than expected following coaching. This raised awareness allowed teachers to adapt their teaching and planning as appropriate.

- Benefits of coaching were longitudinal for teachers and sustained over time. They continued to use strategies that had been discussed in coaching sessions in subsequent school terms.
- There was an increase in teachers' self-efficacy for knowing the case pupils difficulties with learning and what teaching strategies to use. Teachers were particularly confident regarding the implementation of strategies for the case pupil, although slightly less confident generalising their knowledge and identifying another child with working memory difficulties in the future.
- Whilst teachers felt that coaching had a positive impact on their professional development, few teachers perceived coaching to be positively linked to their well-being at work.
- There were some key research informed themes across all coaching sessions including; Baddeley's (2000) multi-component model of working memory, the emotional impact of working memory difficulties, metacognition to develop learner independence, the Instructional Hierarchy (Haring et al., 1978) and the Ebbinghaus Forgetting Curve (Murre & Dros, 2015).
- "It's hard to squeeze in but was worth it" : Although coaching was time-demanding and several competing pressures were noted, all teachers were positive about the coaching process. All stated that they would recommend coaching to others and particularly valued the opportunities for reflection that coaching provided.

The key findings in relation to research question six are:

- Teachers' views and understanding of working memory post-coaching were more in-line with the current research based concept of working memory provided by Gathercole & Alloway (2004) than their views and understanding pre-coaching. For some teachers, there was a large development in their understanding, although for other teachers this development was slightly smaller.

Chapter 7: Discussion

This chapter will firstly revisit the aims of my research before considering the findings from all three phases in relation to wider theory and literature. Following this, I will evaluate the methods used in this research before considering the implications for EP practice and potential avenues for future research.

7.1 The Aims of my Research

The aim of Phase One was to explore teachers' understanding of working memory and how they adapt their teaching practices for students with working memory difficulties. For Phase Two, the aim was to identify students (for Phase Three) who may be "at risk" of having working memory difficulties. For these students who were identified, the aim of Phase Three was to explore whether a coaching intervention could be used with their teachers to develop working memory knowledge, and implement research-informed approaches into everyday classroom teaching. Within this research I adopted a pragmatic approach. In doing so, this allowed me to use abductive reasoning to move between induction (as in the qualitative data approach) and deduction (as in the quantitative data approach). Using both qualitative and quantitative data enabled me to find the best fit solution for concluding my findings.

7.2 Discussion of Phase One Findings : Research Questions One and Two

Research question one was designed to explore teachers' views and understanding of working memory difficulties. Research question two was designed to examine how teachers adapt their teaching practices for students with working memory difficulties.

During the initial teacher interviews (prior to coaching), the term *working memory* was poorly understood by many teachers. However, despite some teachers providing a definition of working memory that was not in line with the current research based concept provided by Gathercole & Alloway (2004), many were

able to identify classroom behaviours associated with working memory difficulties as outlined by Gathercole & Alloway (2007). These included a lack of attention or focus on tasks, difficulties processing or retaining information and the resulting emotional impact for students.

The subsequent teaching adaptations described by teachers were closely tied to teachers' understanding of working memory difficulties. As such, adaptations were predominantly focused on; improving student attention / focus, helping students to process multiple pieces of information, aiming for student consolidation / retention of learning and aiming to improve student resilience, self-esteem, independence and confidence. However, these teaching adaptations were implemented without teachers explicitly stating that they were in place to assist working memory. These findings are discussed in further detail below.

7.2.1 Teacher Lack of Awareness of Working Memory

Out of the ten teachers interviewed, only half stated that they had previously heard of the term *working memory*. Of these five teachers, only three were then able to describe working memory in a way that was connected with the current research-based concept defined by Gathercole and Alloway (2004). These findings are in line with Firth (2018) and Alloway et al. (2012) who note that although teacher awareness and understanding of working memory is often better than that of the general public, there remain significant inaccuracies and misconceptions. One possible reason for these inaccuracies or misconceptions may be due to the lack of CPD or training opportunities available, as this was a factor often noted by teachers.

An alternative explanation for this limited awareness links with research conducted by TEPs at the University of Exeter (Plymouth Group Research Project Report, 2016). The findings from this research note how teachers have knowledge about teaching approaches related to working memory, independent of a research-based understanding or definition. Such notions are reflected by Norwich (2000) who illustrates the relationship between psychology knowledge and teaching practices. Norwich (2000) details how teaching involves the

interaction of two kinds of knowledge; practical knowledge and research translated knowledge. Similar ideas and principles are detailed by O'Hare (2015) who acknowledges the importance of practice-based evidence. In the context of my research, it could be argued that teachers' knowledge of working memory was informed from their everyday teaching practices. This could explain why the teaching adaptations discussed by teachers were based on their implicit knowledge, rather than from a research base. Within the context of an educational setting, it is therefore likely that teachers' understanding of working memory and adaptations are informed predominantly from reflections on their everyday practice rather than from psychological research.

7.2.2 Working Memory and Attention / Focus Difficulties

When asked to think about a child who struggles with their learning (and who may have working memory difficulties), many teachers detailed the attention and focus difficulties that students displayed within the classroom. In their interviews, teachers described the discrepancy in the child's attention and focus in comparison to peers. Some teachers described how students would present in a passive manner, for example daydreaming or "in a world of their own", whilst others described an active presentation by students displaying avoidance behaviours. Teaching adaptations such as shortening tasks, implementing learning breaks and using individual workstations also illustrated how teachers attempted to promote attention and focus within their classroom.

The lack of focus and resulting inattentive, passive and 'zoned out' behaviours described by teachers are typical of the classroom presentations detailed by Gathercole and Alloway (2007) in their working memory guide for teachers. These perceptions are also in line with research that has examined the relationship between working memory and attention. For example, Baddeley (2006) proposes that the central executive operates as an attentional control system, which may explain why some regard working memory as sitting within a broader umbrella of executive functioning including attention (Dawson & Guare, 2018). Others similarly suggest that working memory cannot be separated from attentional processes such as task initiation and response inhibition (Awh &

Jonides, 2001; Hitch, Allen & Baddeley, 2019; Traverso et al., 2020) and may be a form of attention itself (Oberauer, 2019). In addition, some propose that individual differences in alertness and working memory capacity can affect the consistency of attentional control (Redick et al., 2011; Unsworth & Robison, 2020). Such findings therefore pose the question of whether working memory can truly be separated from attention and may explain why lack of focus in the classroom was salient and noticeable for most teachers.

7.2.3 Working Memory and Processing / Managing Cognitive Load

In addition to the difficulties with attention, many teachers also detailed how students had difficulties with processing and managing cognitive load, for example processing multiple instructions. Teaching adaptations attempted to aid these processing and cognitive load difficulties by breaking down instructions or tasks into manageable chunks, differentiating content, providing additional processing time and using multi-modal resources to support learning.

Teachers' perceptions that processing and managing cognitive load is a key part of working memory is in line with research conducted by Bayliss et al. (2003) and Jarrold (2017), who noted the importance of considering processing speed alongside the domain-specific storage demands when evaluating working memory. Students who have a slow processing speed are often unable to filter out irrelevant information which can subsequently lead to inattention or distraction behaviours (Bayliss & Jarrold, 2015; Jarrold et al., 2014). McNab & Klingberg (2008) and Dumontheil & Klingberg (2012) specifically highlight the role of the frontal and parietal lobe in the brain for filtering these extraneous stimuli to assist processing.

An additional model that aligns with these teacher perceptions is Cognitive Load Theory (Sweller, 1988). This theory proposes that if the cognitive load on a task exceeds working memory or processing capacity, this can hamper performance (DeJong, 2010). Cognitive Load Theory is therefore particularly significant for tasks that require high levels of cognitive load, such as multi-tasking (Covre et al., 2019). With regards to my research, findings within the literature therefore suggest that processing and cognitive load are inter-related with working

memory. This is in line with teacher perceptions and these elements should be taken into account when examining working memory difficulties.

7.2.4 Working Memory and Retention / Recall

In addition to attention and processing, teachers also perceived that those with working memory difficulties struggled with retaining and recalling learnt information or applying their knowledge to other tasks and contexts. Teachers noted the subsequent impact this had on completing curriculum tasks, and adaptations included repeating key content and using multi-modal strategies to improve consolidation and fluency. The value placed on retention and recall by teachers is recognised by psychological models, notably Bloom's Taxonomy (Bloom, 1956). Within the cognitive domain of this model, retention is regarded as the core foundational skill and crucial for enabling higher level analytical and evaluation skills. It is possible that in the pressures of the current educational climate, greater value is placed on retention and recall by teachers in order to evidence student progress. As such, this may account for the salience of this theme and the concerns raised by teachers.

7.2.5 Competing Pressures

A theme which appeared to run throughout was that competing pressures exacerbated situations. As illustrated in the 'Competing Pressures' theme, these pressures include curriculum expectations, a lack of access to professionals and the multiple demands placed on classroom teachers in a climate of austerity (i.e. a lack of training opportunities due to cost and time). As research highlights the link between working memory difficulties and attainment (Alloway & Alloway, 2014; Fitzpatrick & Pagani, 2012; Willoughby et al., 2019), competing pressures are likely to place additional demands on teachers who are attempting to evidence student progress. Teaching in a context with competing pressures may also explain why difficulties with sustaining attention, processing instructions or retention of learning were salient for most teachers.

7.2.6 The Emotional Impact of Working Memory Difficulties

The resulting effects of attention, processing and retention difficulties on student self-esteem, self-efficacy, confidence and independence were recognised by many teachers. These are evident in the 'Feelings, Emotions, Affect and Independence' theme. Some teachers detailed how classroom behaviour may include frustration or challenging behaviour, whilst others highlighted how students may present in a reserved or introverted manner. When discussing teaching adaptations, many teachers noted how they aimed to empower students, enhance feelings of self-efficacy and increase confidence through their teaching adaptations.

This link between the emotional impact of working memory difficulties and student presentation in the classroom is acknowledged in the research literature. Evely and Gamin (2013) and Gathercole & Alloway (2007) highlight how those with working memory difficulties may experience low confidence in themselves as a learner. Others such as Alloway et al. (2009a; 2012) detail how those with working memory difficulties were considered troublesome by teachers due to behaviours underpinned by feelings of frustration or low self-esteem regarding their learning. A recent meta-analysis conducted by Moran (2016) also details a cyclical relationship between working memory and well-being. From this meta-analysis of 177 studies, it was concluded that higher self-reported levels of anxiety led to poorer working memory performance. This suggests that there is a two-way relationship occurring between working memory and student wellbeing. In other words, those with working memory difficulties not only experience resulting emotional effects due to their difficulties, but emotional difficulties such as anxiety can also impede working memory. As such, school staff and professionals need to be aware of the resulting emotional impact of working memory difficulties and not overlook the two way cyclical relationship.

7.3 Discussion of Key Findings: Research Question Three

Research question three was designed to explore the pattern of working memory functioning in students classified as “at risk of working memory difficulties” from the WMRS, WISC V and WNV test norms. The findings suggest that teacher ratings from the WMRS placed the majority of students (90%) within either the “Amber” or “Red” range, suggesting that they were at risk of having working memory difficulties. Of these students in the “Amber” or “Red” range, between 44% and 73% subsequently scored within the “Low Average” range on the WMI, AWMI or WNV indexes, and were therefore eligible to be case pupils in the coaching. As such, the WMRS filtered few students and identified the majority as “at risk” of having working memory difficulties. This was originally a somewhat surprising finding because it was hoped that the WMRS and WISC V / WNV follow-up assessment would act as a filter, gradually reducing the number of students who were identified as at risk of working memory difficulties and who were therefore eligible to be case pupils in Phase Three.

Upon reflection however, this research examined a subsection of students who were pre-identified by school SENCos, so the range of scores is restricted and such results are to be expected. In addition to this, scores may have been skewed by the inclusion of an additionally resourced provision within the research. For example, all six students who attended this provision scored in the “Low Average” range or below, making them eligible for coaching. Although the impact of other SEN needs were accounted for by the coach during the assessment and coaching sessions, it is important to consider whether these additional needs caused students to obtain lower scores on the assessment measures. Due to such possibilities, the findings from this research about the WMRS identification should not be generalised on a wider scale.

7.4 Discussion of Key Findings: Research Question Four

Research question four was designed to examine the extent that teacher ratings from the WMRS relate to student scores obtained on the WISC V and WNV. When examining the relationship between WMRS teacher ratings and student scores obtained on the WISC V or WNV, the findings suggest that the teacher WMRS ratings did not have a strong, nor statistically significant association with the WISC V or WNV scores. It therefore cannot be concluded that teacher ratings from the WMRS were associated with working memory test performance. Similarly to research question three, this was also a somewhat surprising finding as it was thought that the WMRS would correlate with the results from the follow up WISC V / WNV assessment. Such findings also pose the question of whether the two students who scored within the "Green" range on the WMRS should also have been assessed using the follow-up assessments.

One reason for this lack of association between the WMRS and the WISC V / WNV could be because (as stated in Section 7.2.1), teachers' understanding of working memory is informed by everyday practice rather than from psychological research. It is therefore possible that teachers' perceptions led to higher ratings on the WMRS and this did not align with the level of need reflected in the WISC V or WNV assessments. Alternatively, these findings could be due to other factors such as the student sample. For example, the WMRS was standardised in North East England on a population who all had English as their first language. This is not necessarily representative of students who participated in this research, who attended a school within an Outer London borough and who were from a range of ethnic backgrounds. As such, this may account for why the majority of students scored highly on the WMRS but were subsequently not eligible for the coaching intervention. It is also important to note that the WMRS validity was originally evaluated using descriptive statistic comparisons with the AWMA and WISC IV, both of which have now been discontinued.

7.5 Discussion of Key Findings: Research Questions Five and Six

Research question five was designed to examine the extent that a coaching psychology intervention could be used with Key Stage Two teachers to develop their understanding and identification of working memory difficulties, and implement research informed approaches into their teaching practice. Research question six was designed to explore the extent that teachers' views and understanding of working memory difficulties change following a coaching psychology intervention.

As previously stated, the findings from Phase One suggest that teachers' definitions of working memory were initially un-aligned with the current research based concept. Despite this, many teachers expressed a desire to engage in learning and research in order to develop their professional understanding. These desires reflect that teachers have some motivation for change and a sense of self-determination (Ryan & Deci, 2000). The authors of Self-Determination Theory acknowledge the impact of the environment or context when developing the three core psychological needs; autonomy, competence and relatedness. Environments that lend themselves to fostering these key elements allow for greater internalisation by individuals and greater commitment.

An environment that lends itself well to developing teacher self-determination and understanding of working memory is coaching. The post-coaching data suggests that following coaching, teachers' views and understanding of working memory were aligned with the definition provided by Gathercole and Alloway (2004). In addition to this, teachers reported that coaching had a positive impact on professional development and reported that their understanding of working memory had improved either more or much more than expected. The results from the online follow up questionnaire illustrated that such benefits were sustained over a period of time. Teachers did acknowledge that in a busy school environment, there were often several other competing pressures. But, despite these pressures, coaching was valued particularly for the reflection and joint problem solving opportunities provided.

The post coaching data also illustrated that following coaching, all teachers reported higher levels of self-efficacy regarding their understanding of working memory and ability to identify students with working memory difficulties in the classroom. This raised awareness appeared to also motivate teachers to adapt their teaching and planning. The importance of higher levels of self-efficacy within education and teaching is noted in the literature. For example, higher levels of self-efficacy amongst teachers is associated with positive attitudes and behaviours towards inclusive teaching environments and student success (Emmers et al., 2020; Kristiana, 2018; Sharma & George, 2016; Sokal & Sharma, 2014). Some also recognise the influence of other factors within the educational context on self-efficacy levels, including support systems and leadership (Hoy & Woolfolk, 1993; Korte & Simonsen, 2018; Tschannen-Moran and Woolfolk Hoy, 2002). The findings from these research studies therefore illustrates the benefits of increasing teacher self-efficacy for promoting inclusive teaching settings, and the role of contextual factors for mediating self-efficacy levels.

The findings from my research therefore highlight how coaching can create an enabling environment that empowers teachers, fosters self-efficacy and changes understanding. Such findings are in line with Adams (2015) who notes that coaching adopts a person-centred approach with the aim of enabling growth and development. Core elements of coaching psychology such as the collaborative alliance, non-directive and facilitative approach help to build feelings of competence for the coachee and increase intrinsic motivation. Many of these elements also overlap with other models of professional learning development such as lesson study (Norwich, 2018) and existing consultation frameworks such as the Problem Analysis Framework (Monsen et al., 1998). For example, the I-GROW model used in this research incorporated similar elements to the Problem Analysis Framework such as outlining roles and expectations, generating hypotheses, jointly deriving outcomes and actions, followed by joint-evaluation. The collaborative and facilitative spirit underpinning coaching also aligns with Wagner's (2000, 2008) views about consultation.

Therefore, it could be argued that through the use of coaching, EPs can be agents of change. For some teachers, engaging in coaching helped to unlock ideas for teaching adaptations and strategies that they had not previously considered. This

notion of unlocking ideas and bringing them to conscious awareness links to the Johari window (Luft & Ingham, 1955). With regard to this research, I was able to support teachers to shift information and ideas from their blind spot to the open self through coaching discussions.

In addition to being agents of change, this research illustrates the linking of theory to practice. There were six key theoretical ideas discussed across the seven coaching cases. These theoretical ideas included psychological models such as Baddeley's (2000) multi-component model of working memory, the Instructional Hierarchy (Haring et al., 1978) and the Ebbinghaus Forgetting Curve (Murre & Dros, 2015). Discussions also included the application of research studies to practice, particularly the links between working memory and the functions of different brain areas, or working memory and other forms of SEN.

One particular area of discussion, however, was metacognition. This was discussed in six out of the seven coaching cases and was often considered as a result of teachers hoping to develop learner independence and self-awareness of strategies. Discussions with teachers included work conducted by Flavell (1979) and Feuerstein et al. (1980), alongside implementation guidance from the Education Endowment Foundation (2020). Teaching strategies used to promote metacognition included teachers modelling their own thinking, and encouraging students to reflect on and name strategies they used to support their learning. The importance of developing metacognition in schools to support student working memory is prevalent given the links between metacognition and student progress (Education Endowment Foundation, 2020; Jones et al., 2019). Over the last two decades, there has also been a substantial body of research examining how metacognition principles can be applied in a systemic manner, resulting in a large number of Thinking Schools being set up across the U.K. (Burden & Nichols, 2000; Burden et al., 2010; Thinking Matters, 2020). With regard to this research, it seems imperative that systemic strategies to develop metacognition, student independence and awareness of strategies continue to be used to support students with working memory difficulties in the classroom.

7.6 Contribution to Knowledge

Research previously conducted within the field of working memory has largely focused on improving working memory through costly and time intensive training programmes, for example Cogmed (Cogmed, 2016), Jungle Memory (Memosyne Ltd., 2011) and Lucid Memory Booster (GL Assessment, 2017). The evidence for these programmes, however, is weak and there has been little research focusing on how to support working memory systemically. Alloway and Gathercole (2007) published some guidance for teachers to help support students, although there was little, if any, research that explored how this information was translated into teachers' pedagogic practice. As such, within the field of working memory there was a gap between the empirical research knowledge and the real-life everyday application.

This research was novel because it attempted to bridge this gap that existed between empirical research knowledge and everyday application. In other words, this research took an established theoretical working memory model from the field of cognitive psychology and applied this in an everyday educational context through the use of coaching psychology techniques. Such approaches of linking theory to practice are a unique and key part of the psychologist's role, as outlined in the BPS Practice Guidelines (The British Psychological Society, 2017). Studies that had examined the effects of educational coaching in other developmental areas also yielded largely positive results (Davis et al., 2018; Dudek et al., 2019; Grant et al., 2010).

Providing this link between theory and practice using a model of professional learning, meant that teachers were able to develop their teaching practice by trialling and implementing working memory strategies within a reflective coaching context. This practical approach differs to other CPD opportunities such as training courses, where learning or knowledge may become static if it is hard to apply in an educational context. As Adams (2015, p.153) states, "exotic blooms that thrive elsewhere may not readily transfer to new environments." My research therefore provides an example of how adopting a practical approach and model of professional learning for teachers (coaching) can enable theory to transfer to practical application.

7.7 Critique of the Research

This research has many strengths, particularly with regards to the unique contribution to knowledge. In addition, the use of both qualitative and quantitative methods provides both breadth and depth to the findings. The multiple identification methods used in Phase Two also ensure a comprehensive process for identifying those students who were “at risk” of working memory difficulties.

It is important however, to consider the potential methodological limitations in order to support future research. The first limitation is that this research examined coaching using a pre-intervention and post-intervention evaluation with a small sample (and therefore did not use an experimental design). This means that any findings may not be representative on a wider scale, for example if the research was conducted again in another area of the country, or if a control group was included. Although conclusions cannot be drawn on a large scale about these findings, it should be noted that the aim of this research was exploratory. Therefore the findings are intended to illustrate what coaching can offer in terms of professional learning for teachers rather than making wider scale claims.

A second limitation is due to many competing pressures (also noted by teachers within the study), coaching sessions were not always prioritised by school staff. For example, some teachers found it hard to obtain cover for their class in order to be released for the coaching and this constrained coaching sessions to a maximum of 30 minutes. It was felt that this time limit did not provide adequate time to review goals and allow teachers to engage in in-depth reflection. In addition to this, some of the teachers worked on a part-time basis which may have affected the consistency of teaching adaptations being implemented in class following the discussions from the coaching sessions. Other competing school pressures meant that some teachers took part in Phase One in early September without having a good understanding of the case pupils’ needs. This may, therefore, have limited the discussion that occurred within the interviews. Although these were limitations for the research, they also illustrate the conditions required in order to facilitate quality coaching sessions in schools.

The final limitation identified concerns the case studies used in Phase One. These were used to encourage teachers to think of students from their class, however it is possible that reading these case studies may have primed or encouraged teachers to think about students who presented similarly to those in the case studies. For example, a student who lacks focus in class or struggles to process instructions. In future, it should be considered how best to encourage teachers to identify students with working memory difficulties, without the possibility of a priming effect.

7.8 Avenues for Future Research

As noted by some, coaching psychology is an effective, albeit novel and emerging discipline (Adams, 2015). As such, developing an evidence base for coaching should be a priority. One potential avenue would be to examine the longitudinal impact of coaching or to compare the impact of coaching against a control group. It is hoped that these findings will contribute to the growing research base in the field of coaching, and will be shared at a professional conference in the future.

Within this research, I have discussed how coaching shares similar principles to consultation frameworks such as the Problem Analysis Framework (Monsen et al., 1998). There is further scope to explore whether principles from other consultation frameworks such as the Interactive Factors Framework (Frederickson & Cline, 2009) could be used in coaching discussions about working memory. This may be of particular interest to teachers who are interested in the biological aspects of working memory.

A final avenue for future research concerns the current state of affairs and the COVID-19 pandemic. This crisis has seen schools become reliant on distanced learning and contacting professionals in a virtual manner. As such, the role of technology and opportunities for virtual coaching should be explored. Although this research illustrates how coaching can be an effective and valuable process, it is time consuming and conducting coaching by virtual means may help to eradicate some of these demands. In light of COVID-19, the identified link between anxiety / mental health and working memory performance (Moran, 2016)

is perhaps more prominent than before and these systemic factors should be considered in the context of classroom learning.

7.9 Implications for Educational Psychology Practice

As previously noted, the nature of this research was exploratory and small-scale. However, there is potential for the findings of this research to be transferred to similar contexts and wider educational psychology practice.

Firstly, the research highlighted a general lack of consensus amongst teachers regarding their understanding of the term *working memory*. It may therefore be useful for professionals (including EPs) working in school settings to be clear about the term, and to not assume that teachers will have prior knowledge or constructs which align with the current research based concept. Consideration may also be given to delivering specific training about children's cognition (including working memory difficulties) as part of teachers' initial training, or as an aspect of CPD.

Secondly, this research highlights the potential for using coaching psychology techniques to support working memory in a systemic manner and empower teachers to make positive changes. As Macleod et al. (2007) would argue, teachers are often best placed to affect change within the educational system, which can allow psychologists to work systemically to create a wider and deeper impact. The findings from my research illustrate how psychologists can operate within a systemic model and ensure breadth and depth of impact as coaching methods can be used to support the teachers, who in turn support the students. Adopting such an approach also has close ties with Ecological Systems Theory (Bronfenbrenner & Morris, 2006; Tudge et al., 2009). With regards to my research, I was able to integrate psychological theory from the Exosystem and Mesosystem into my practice. Then, by working with teachers at the Microsystem level, this had subsequent effects for the individual students. This way of working is similar to the Realisation System detailed by Lester (2015). In a Realisation System, outcomes are co-produced and those who are in the best position to enable change are empowered by being given the skills to respond. Such views tie in with those of Miller (1969) who believed in the transformative power of

psychology and advocated that psychologists should be “giving psychology away.”

Within this research, however, the notion of sharing psychology or giving it away was not without challenges. Most notably working in a co-constructed manner with active experimentation of strategies was novel to some teachers who viewed my role as operating within a Delivery System (Lester, 2015). These teachers therefore expected me to give them strategies or provide a solution to the problem based on my ‘expertise’. In these situations, the psychologist’s unique contribution and enabling skills may go un-noticed to those who are expecting a ‘top-down’ Delivery System approach. Other research has also noted the challenges psychologists face within the current traded environment and how to sell their psychology at the same time as giving it away (Allen & Hardy, 2017). Although this was not a concern within my research, it is something which should be considered for future coaching psychology work within a traded service.

Thirdly, engaging in coaching provides an opportunity for EPs to diversify their practice (Adams, 2016). Coaching provides opportunities for EPs to engage in early intervention involving a cyclical Assess, Plan, Do, Review framework with regular review and the opportunity to build consistent relationships with school staff. Within everyday EP practice, there can be limited opportunities to engage in work with this exclusivity of focus, and such opportunities can often be overlooked or missed (Fanshawe, 2019).

The final implications for educational psychology practice relate to our need as psychologists to use professional empathy skills (Halpern, 2003) to recognise and understand the competing pressures faced by school staff. This research highlighted several competing pressures experienced by teachers, namely curriculum pressures, a lack of access to professionals and the multiple demands placed on classroom teachers in a climate of austerity (i.e. lack of training opportunities due to cost and time). These pressures often exacerbated situations for teachers and consequently affected the implementation of teaching adaptations. Using practitioner skills such as professional empathy can help EPs to understand why teacher concerns about students sustaining attention, processing instructions or retaining learnt content were so salient. In addition to

the competing pressures, many teachers stated how they valued coaching because it provided them with a space and time for reflection and joint problem solving. Recognising the value of supervision for teachers should therefore be at the forefront of EP practice. In doing so, this will enable those who are best placed to create change within the educational system, which in turn will positively support students.

7.10 Conclusion

The findings from this study contribute to a growing research base in coaching psychology, which is an emerging discipline in the field of educational psychology. This research is novel because it links theory and practice by bridging the gap between empirical research knowledge about working memory, and the everyday application within education settings. The results of this research illustrate that where there is a lack of teacher knowledge regarding the term *working memory*, coaching psychology techniques can be used to improve teachers' understanding and identification using research based strategies. This raised awareness had subsequent positive effects for teachers' planning, classroom practice, professional development and self-efficacy. Despite the many competing pressures noted by teachers themselves, coaching was valued especially for the reflection and joint problem solving opportunities provided.

The findings of this research highlight that through using coaching psychology techniques to support teachers, EPs can be agents of change. By "giving psychology away" and linking theory to practice through coaching, those who are best placed to create change within the educational system (such as teachers), are empowered and given the skills to respond. Although this was a small-scale piece of research with some methodological limitations, the findings are encouraging. The research highlights the many opportunities for EPs within the profession to diversify their practice, and adopt the use of coaching psychology techniques within their everyday work to promote working memory friendly schools.

7.11 My Reflections from Engaging in the Research

When I began my doctorate training in September 2017, I set myself six goals that I hoped to achieve throughout my DEdPsych journey. One of these goals was to conduct a piece of doctoral level research that had a significant impact on my professional practice and may be published in future. I believe that throughout my thesis journey, I have accomplished this goal.

Prior to undertaking this research, coaching psychology was a novel area for me. Engaging in this form of action-research has meant that I have developed my awareness of coaching psychology and witnessed first-hand the positive benefits that it can provide for educational practice. Applying coaching psychology techniques has enabled me to make clear and explicit links between psychological theory and practice, and communicate this in a practical and accessible manner. These links between theory and practice were not restricted to working memory but also included wider links such as metacognition and the Instructional Hierarchy. Adopting a “hands-on” research approach also enabled me to develop my own skills as a practitioner. Since undertaking my doctoral research, I have continued to apply some of the coaching skills to situations within my local authority work, and I am keen for this to continue and develop.

As outlined in Sections 7.7 and section 7.9, there were some constraints and competing pressures encountered when conducting the research. These included time constraints that limited the individual coaching sessions or the programme of coaching, as well as highlighting the importance of clarity and communication regarding roles. However, I believe that such constraints and competing pressures are an inevitable part of the system that EPs work in as practitioners, and therefore reflect the challenges of conducting research within an everyday educational setting. Despite these challenges, this research highlights how coaching can provide a “hands on”, accessible and practical opportunity for EPs to diversify their practice. My vision is that these positive findings of using coaching psychology techniques can be disseminated so that more EPs will support students with working memory difficulties in a systemic manner rather than through conventional training programmes that have been shown to have limited effectiveness.

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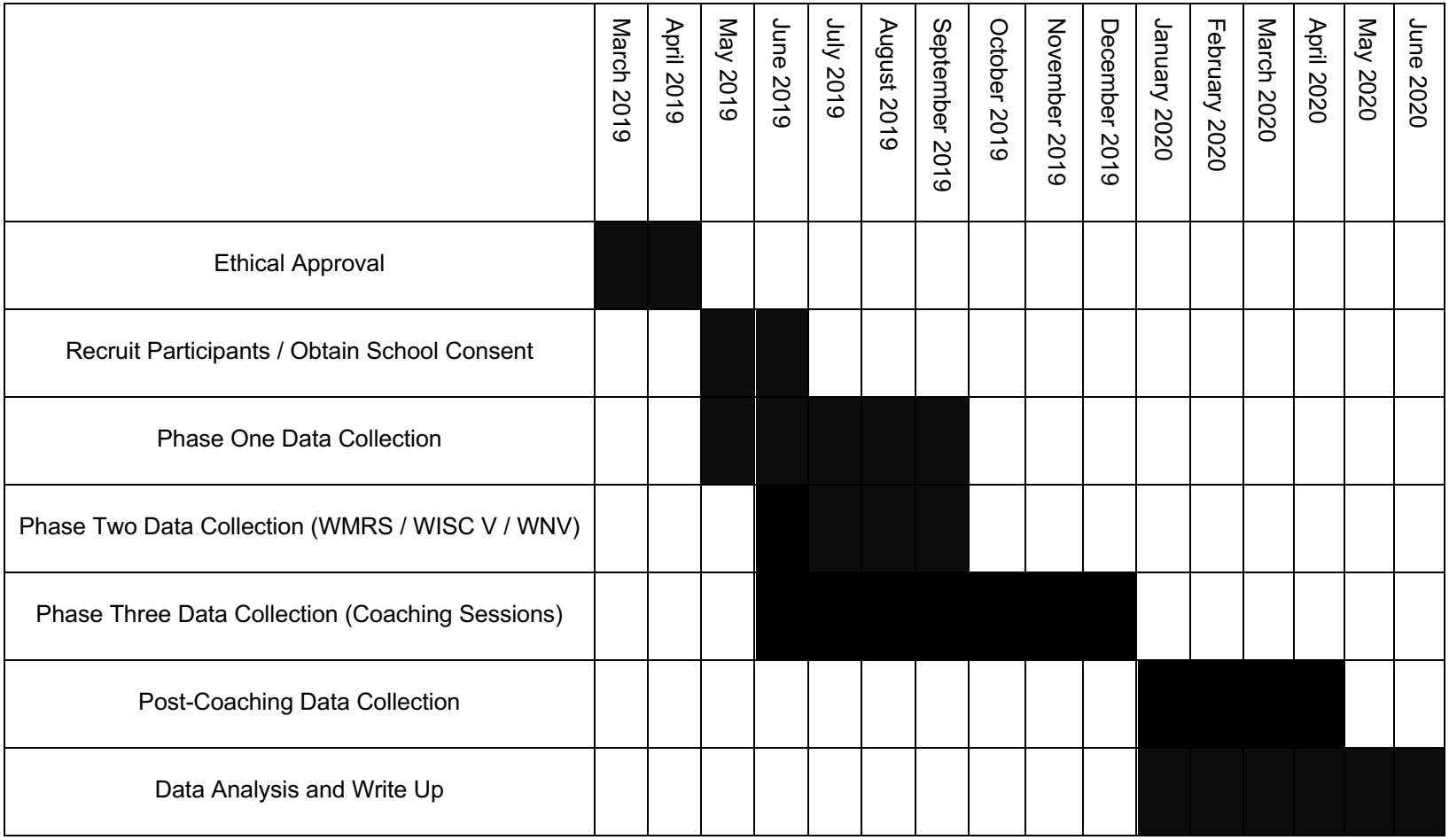
Appendices

CONTENTS

Appendix 1: Timeline of Thesis Research



Appendix 2: Information Sheet Sent to School SENCOs

"Working Memory Friendly Schools" Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools

Why Is It Important?

Research suggests there is a link between working memory difficulties and learning difficulties, classroom inattention or poor attainment. To date, efforts have focused on improving a child's working memory through the use of costly and timely student training programmes, with little focus on the supports used within the wider classroom environment. There is some published working memory guidance available to teachers, but it is unknown how much this is translated into everyday teaching practices. This research project aims to therefore examine how Educational Psychologists (EPs) can use coaching psychology techniques to enable research knowledge and guidance about working memory to be translated into classroom teaching practice.

Involvement in the research will be useful for schools as it will help teachers to identify which students may be at risk of working memory difficulties and help to support these students in the classroom.

What Is Coaching?

Developmental coaching provides teachers with a confidential space to reflect on their practice and impact. It is **non-evaluative** and **non-judgemental**.

The focus is very much on looking for what teachers are already doing well and finding ways to build on this.

Coaching may involve the following activities:

- Eliciting and building on existing strengths
- Setting clear goals
- Considering options for moving forward
- Agreeing a developmental plan
- Considering how to maintain improvements

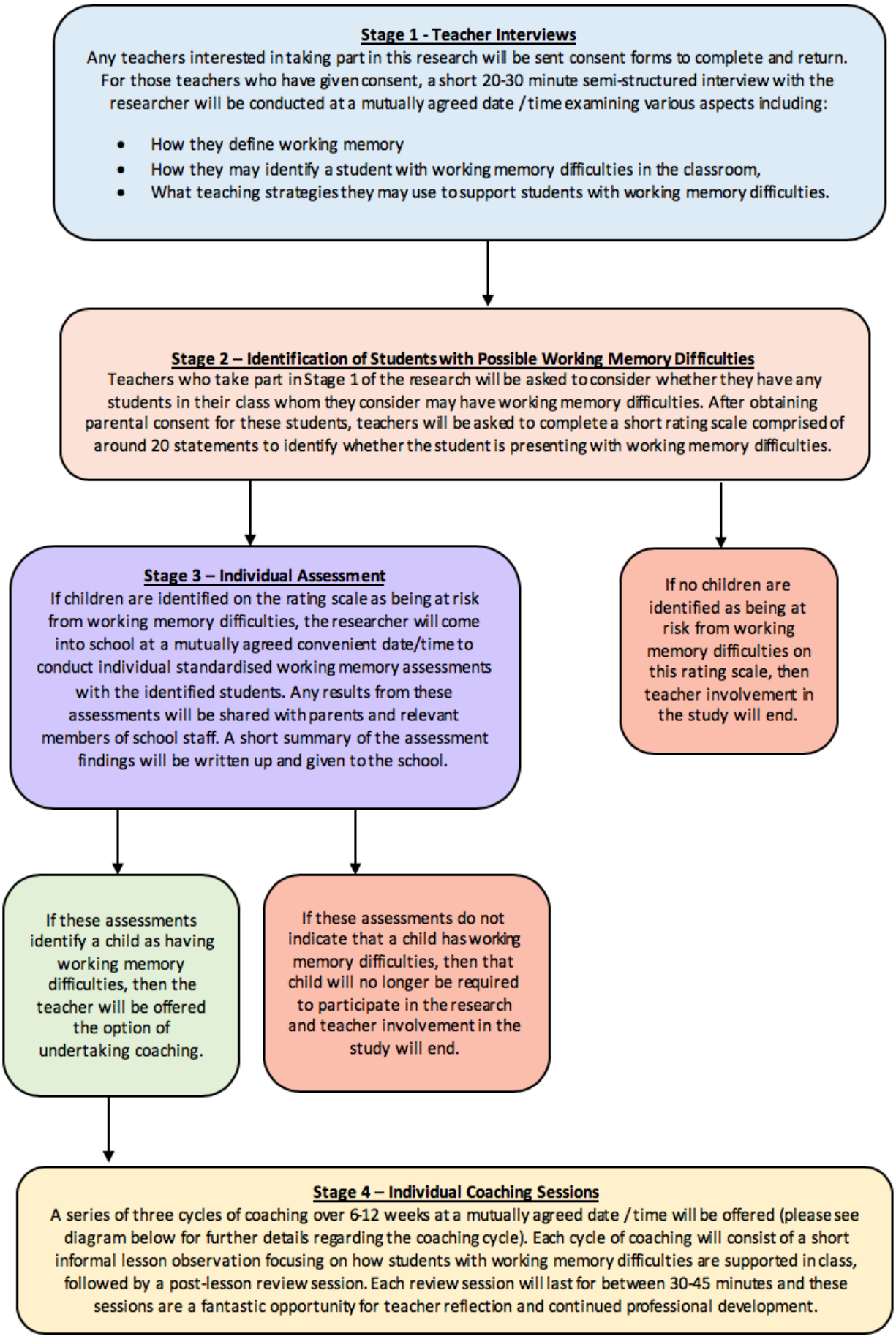
Coaching consists of an initial contracting session where information and expectations are detailed. A cycle of informal lesson observations will then take place where I will make notes about strategies and the impact they have, followed by post-lesson reflective coaching sessions where I will help teachers to reflect on their practice. All observations and sessions are confidential.

Who is Conducting the Research?

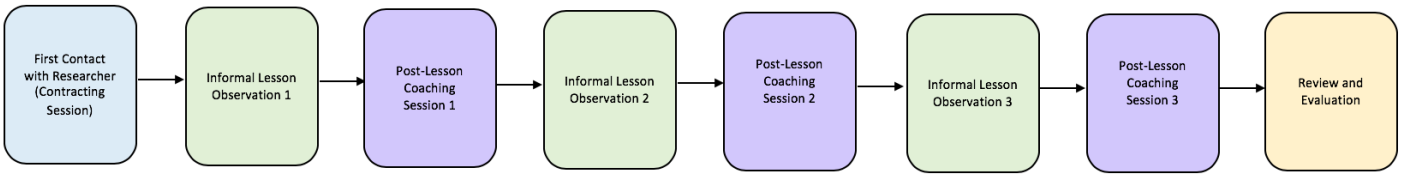
The research is being conducted by myself, Kiera Farrelly. I am a Trainee Educational Psychologist at the University of Exeter, who has enhanced DBS clearance. I also work part-time in the Educational Psychology Service at XXX. The research project is being supervised by Professor Brahm Norwich at the University of Exeter.

What Does The Research Involve?

The research has four stages



The structure of the coaching sessions will be as follows:



What Will You Gain From Taking Part In The Study?

As a school you will receive:

- Information about the identification of students who may have working memory difficulties from a screener rating scale.
- Individual student assessment data on standardised assessments examining working memory.
- Opportunities for teachers to engage in CPD by taking part in coaching to improve classroom practice for students at risk of working memory difficulties.
- A short report of the research findings upon completion of the research.

Results from the research may be written up for publication with an aim to better inform the academic literature on how coaching can help to inform classroom practice. If this occurs, then your school will also receive a copy of the academic publication.

What Should I Do If I Wish To Take Part?

The consent slip (please see below) will need to be completed by the headteacher or a member of the senior leadership team. This will need to be returned via email to the researcher Kiera Farrelly at XXXXXX.

Data Protection

All data will be treated confidentially and held in accordance with the Data Protection Act.

Any information provided will be used for research purposes and processed in accordance with current data protection legislation and university guidelines. Personal data will be treated in the strictest confidence and will not be disclosed to any unauthorised third parties. The results of the research will be published in anonymised form.

Audio recordings of interviews will be deleted as soon as there is a written anonymised transcript of the interview. Consent forms, rating forms, and standardised assessment scores will be held until the end of the research (September 2020) and then will be destroyed.

Any data from your school will only be accessible to the researcher and your school. Coaching discussions will be confidential and only available to the researcher and participating teacher. Once the analysis is completed the pupil data will be deleted, unless you wish to retain information for your own school records.

If you would like to discuss this research further, or have any questions or concerns about this, please email Kiera Farrelly at XXXXX.

Appendix 3: Headteacher / Senior Leadership Team Consent Form

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For headteacher or member of senior leadership team to complete:

I have read about the '"Working Memory Friendly Schools": Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools" research study, and I understand the basis for our involvement.

I consent to the school taking part in this research and understand that the school can withdraw from this study at any time:

Name:……

Role:……

Signature:……

Date:……

Many thanks for your time.

Appendix 4: Information Sheet and Consent Form Sent to Teachers

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"Working Memory Friendly Schools"
Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools

Why Is It Important?
Research suggests there is a link between working memory difficulties and learning difficulties, classroom inattention or poor attainment. To date, efforts have focused on improving a child's working memory through the use of costly and timely student training programmes, with little focus on the supports used within the wider classroom environment. There is some published working memory guidance available to teachers, but it is unknown how much this is translated into everyday teaching practices. This research project aims to therefore examine how an Educational Psychologist (EP) can use coaching psychology techniques to enable research knowledge and guidance about working memory to be translated into classroom teaching practice.

Involvement in the research will be useful for schools as it will help teachers to identify which students may be at risk of working memory difficulties and help to support these students in the classroom through individual confidential coaching sessions with a Trainee Educational Psychologist.

What Is Coaching?
Developmental coaching provides teachers with a confidential space to reflect on their practice and impact. It is **non-evaluative** and **non-judgemental**. The focus is very much on looking for what you are already doing well, and finding ways to build on this.

Coaching may involve the following activities:
- Eliciting and building on existing strengths
- Setting clear goals
- Considering options for moving forward
- Agreeing a developmental plan
- Considering how to maintain improvements

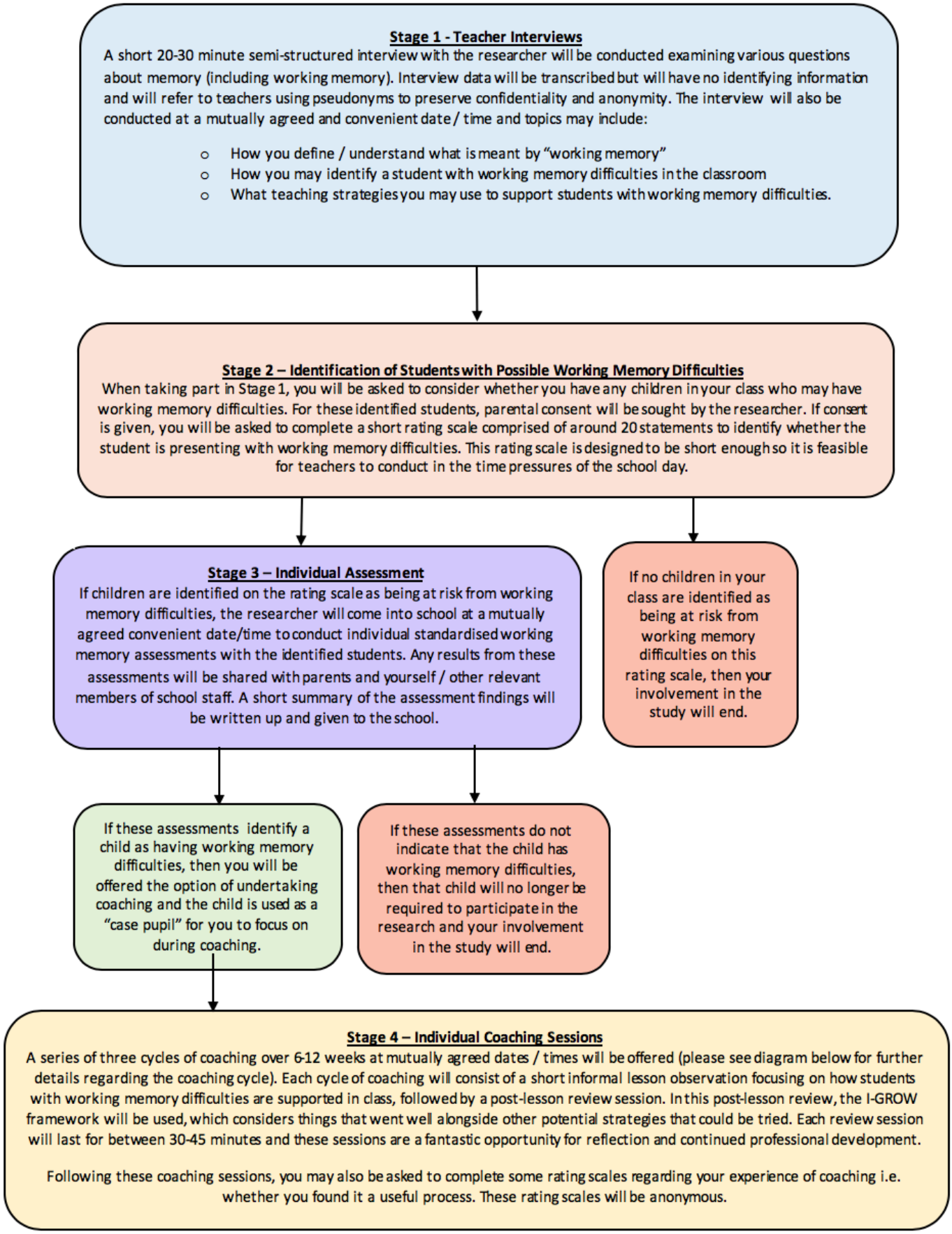
Coaching consists of an initial contracting session where information and expectations are detailed. A cycle of informal lesson observations will then take place where I will make notes about your strategies and the impact they have, followed by post-lesson reflective coaching sessions where I will help you to reflect on your practice. All observations and sessions are confidential.

Who Is Conducting The Research?
The research is being conducted by myself, Kiera Farrelly. I am a Trainee Educational Psychologist at the University of Exeter, who has enhanced DBS clearance. I also work part-time in the Educational Psychology Service at XXX. The research project is being supervised by Professor Brahm Norwich at the University of Exeter.

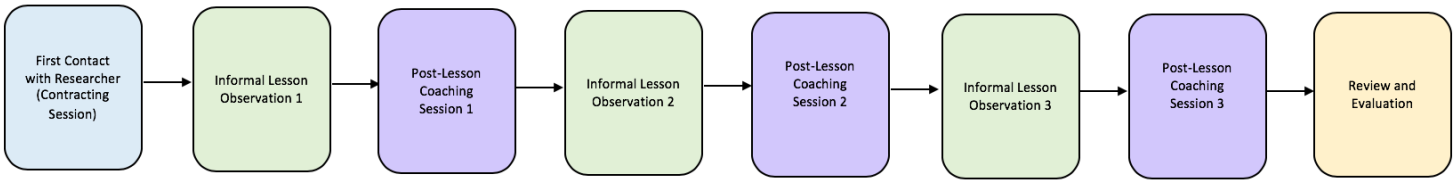
Why Am I Being Contacted?
You may have children in your class who fall into the age range taking part in this project and who may have working memory difficulties, and who are therefore eligible to take part in this research.

What Does The Research Involve?

By taking part in this research, you may be asked to take part in up to four stages of the research:



The structure of the coaching sessions will be as follows:



Data Protection

Any information provided will be used for research purposes and processed in accordance with current data protection legislation and university guidelines. Your personal data will be treated in the strictest confidence and will not be disclosed to any unauthorised third parties.

Rating scale data and standardised assessments will be treated confidentially and held in accordance with the Data Protection Act. This data will only be accessible to the researcher and school staff, and would only be used with the intention to help support that child's learning. Once the research is completed (September 2020) the rating scale data will be destroyed. The standardised assessment scores may be retained by school staff for future use.

Teacher coaching discussions will be confidential and only available to the researcher and participating teacher.

Interview data will be anonymous. The audio data will be deleted after transcription and transcripts will include pseudonyms and only be accessible to the researcher and stored on a password protected computer.

What Will Happen with The Results from the Study?

The results of the research will be published in anonymised form and a short summary report will be produced. Following completion of the research, results from the study may be written up for publication with an aim to better inform the academic literature on how to support children's working memory within schools. If this occurs, all data will be anonymous and your name or school information will not be available on any publication.

What Should I Do If I Wish To Take Part?

If you are happy to take part in this project, please sign the consent form below and return to Kiera Farrelly at XXXXXX.

If you would like to discuss this research further, or have any questions or concerns, please feel free to email the researcher Kiera Farrelly at XXXXXX.

Consent Form for Teachers Participating in the Research:

I have read about the “Working Memory Friendly Schools”: Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools” research study, and understand the basis for my involvement.

I consent to take part in this research including the interviews, rating scales and coaching, and understand that I can withdraw from this study at any time:

Name:……

Role:……

Signature:……

Date:……

The original copy of this form will be kept by the participant and a scanned copy will be kept by the researcher. Your contact details will be kept separately from your interview data.

Appendix 5 : Case Studies for Phase One

Please have a read though some of the following short case studies and think whether there is a child in your class who perhaps displays similar difficulties with their learning.

Case Study 1 - Nathan

Nathan is a seven-year old child whose reading and maths are below age expectations and he is struggling with many classroom activities.

- He often fails to follow instructions such as “Put your sheets on the green table, cards away in the packet, put your pencil away and come and sit on the carpet.” Typically, he will complete the first part of the instruction and proceed no further.

- He also makes errors in activities that involve remembering even small amounts of information at the same time as processing other material.

- Often he loses his place in complex tasks, making errors such as skipping important steps or repeating them. Nathan’s teacher says that he has a short attention span, and is easily distracted.

Case Study 2 - Maddie

Maddie is a ten year old quiet child who is well-behaved in the classroom, but who is struggling to learn in literacy and numeracy. Her teacher has observed:

- That she often fails to listen to what is said and is often “in a world of her own.”

- She often struggles to keep up with classroom activities. For example, when the teacher wrote on the board ‘Monday 11th November’ and, underneath, ‘The Market’ (which was the title of the piece of work), she lost her place in the laborious attempt to copy the words down letter by letter, writing ‘moNemarket’. It appeared that Maddie had started to write the date, forgotten what she was doing and began writing the title instead.

- She also frequently fails to complete structured learning activities. In one instance, when her teacher handed her the computer login card and told her to go and work on the computer numbered 13, she failed to do this because she had forgotten the number of the computer.

Appendix 6 : Interview Schedule

	Question	**Follow Up Questions**
Background Questions	• Can you clarify your role for me? • How long have you been teaching for? • How long have you been specifically teaching in Key Stage Two For? • Can you clarify what type of provision you teach in? Is it a mainstream or special primary school? • What interested you in taking part in this research?	
1.	**Think of a child who you teach who perhaps struggles with their learning. What do you notice about the child?**	
		• What behaviours do you see in the classroom? • Are difficulties shown across various tasks or lessons? • Have you sought any help / advice from outside professionals? If so, from who?

		• Do you adapt your teaching for this child? If so, can you describe what things you do? o Why do you do these things? o Do you feel that these adaptations have a positive impact on the child's learning? If so, what do you notice?
2.	**Have you ever heard about working memory?**	
		If so: • Can you remember where you heard about it? • Have you ever been on a course or training that has talked about working memory?
3.	**Can you describe what you think the term "working memory" means? / What does the term mean to you?**	
		• Is working memory just a term or is it meaningful for you in the classroom? • What do you know about how memory works? Have you heard of other types of memory? • Which tasks do you think may require the child to use working memory in the classroom?

		• What tasks in the classroom may a child who has working memory difficulties struggle with?
4.	**Do you believe that memory, specifically working memory can be improved?**	
		If so: • How do you think working memory may be improved?
5.	**Do you have any measures at school to assess working memory?**	
		If so: • Who carries out this identification? • What tools / resources do you use to do this? • Do you have any preparation / training for this? • Is staff training on working memory provided?
6.	**Is there anything else you would like to add which we have not covered?**	

Appendix 7 : Sample of Coded Interview Transcript

classroom behaviours | teaching adaptations | heard of working memory?
whether difficulties are across tasks/lessons | why do adaptations? | definition of working memory
help from other professionals | do adaptations have a positive impact? | comorbidity

35 **Me: So three that are slightly maybe lower than the others?** constraints
36
37 Yeah
38
39 **Me: Okay, so what really interested you in taking part in the**
40 **research?**
41
42 Erm I think that as a class teacher, there are things you think "what
43 can I do to help these children more?" when particularly those children
44 who are maybe slightly below the majority of the class don't have inclusion
45 support maybe of their own. And we need to find some ways to help
46 them to access in the same way that everybody else does when they
47 might have these sorts of issues around working memory. And they
48 don't necessarily have more support of their own, I think it is definitely
49 useful to have techniques and ideas to help with that.
50
51 **Me: Yeah brilliant. Okay, so obviously you have had a look at the**
52 **case studies. Can you perhaps think about a child or a couple of**
53 **children in your class who struggle with their learning. And can**
54 **you maybe just detail for me, what is it you notice about those**
55 **children in the lesson? What are they doing?**
56
57 I think erm, I've got certain children I can think of who are more of the lack of focus
58 "Nathan" case study where they have a lot of lost focus, frustration
59 over their learning and are here there and everywhere, possibly to frustrated
60 detract from getting on with a task they don't fully remember. And then
61 I think I also have got a number of children who I can think of who they masking difficulties
62 are doing as they are asked to do, they are working really hard at that,
63 but when it comes to their learning, they are getting knocked down or
64 frustrated by not remembering small things that they know we have
65 learnt about or they know they should remember, and then they are
66 not able to..they are not able to piece all of those elements together.
67 And I think that can be quite frustrating for them I have noticed. It's like
68 "why don't you still remember this?" or like we try not to get them to

feel negative about it but it's a lot of repetition and I think they recognise the repetition maybe but don't feel. They can't see that they are making progress and I think that can be quite disappointing for them as well and disheartening.

emotional impact of difficulties

Me: So they are aware of where they are in that sense? And like you say, they are quite frustrated about that as well then?

Yeah

Me: Okay, and is that typical of all the children you are thinking about in your mind in the class?

Yeah I think I've got a few that. The ones who I had thought of, there are a couple who are more this Maddie and well-behaved, quiet, doing the right thing. So there are two children I can think of who are, they are slightly below everybody else in the classroom but not the ones necessarily with the 1:3 support. That's where we need to have some techniques to help them and then I have definitely got a Nathan character I can think of too! (laughs)

keen to learn

below peers

inclusion

Me: Okay, so quite a few that come to mind then?

Yep

Me: Okay brilliant. So, obviously we have spoken about what you see in the classroom in terms of behaviours. Is that shown across different lessons or is it mainly literacy, numeracy?

Literacy and numeracy for those who are slightly below and then with the child who is more distracted, that is across everything I would say.

difficulties across tasks including literacy and numeracy

Me: Yeah

So he gets more distracted. But the other two girls, it is across their literacy and numeracy really.

Me: Okay, and with those children has anyone been in before to see them?

No

no outside involvement

Me: Advice hasn't been sought by Speech and Language or?

No we have had a question mark about a dyscalculia or something like that for one of the girls but that has only been recently that I have started to discuss that. So they have always just been slightly below age related and not had any extra intervention, other than what we do within a classroom.

WM and dyscalculia

Me: Okay, but no outside input or involvement?

No

Me: Okay so with those children in mind, do you find that you have to adapt your teaching style for them?

Yeah I think that the whole class teaching doesn't necessarily adapt but the way that I will talk to them, we might go back and remind ourselves of things or try and bullet point erm the steps to success for how we are going to get here, what we are going to do then. So they can layout a plan of action I suppose, and then going back a lot to repetition and just doing the same smaller activities again, particularly in maths. To try and build up that confidence is what I have been doing so far.

adaptations are not whole-class

breaking tasks down

repetition

increase confidence

Me: So like you say going back over the task, re-learning aspects of it?

Arithmetic I think if they have got that, then the other things might fall into place a bit more. But the arithmetic I think when they are just feeling completely like it's just a bunch of numbers and they can't remember each of those strategies. Just trying to go back over them.

repetition

Me: Okay so obviously what is it then that you are trying to achieve by doing those strategies? Why do you do them?

I think to give more confidence and to give more fluency. So that they can think "I know how to do this, I have done it yesterday." So there is a more recent memory rather than it being trying to pull back to something that feels like it was ages ago for them.

increase confidence

improve fluency and retention

Me: Okay and do you feel by doing that, it has a positive impact on the child's learning?

Yeah, and I think their emotional. Their wellbeing as well, they seem a lot more positive after they have felt like "oh yeah I am doing better. I can see a progress in myself." I think that there is a progress and they feel it for themselves emotionally a little bit better about it I think.

has a pasitive emotional impact

Me: So it is a two pronged approach – in the sense that it is you helping their learning but also boosting the emotional feelings?

Yeah they have more confidence and think "yes I can do this next time."

boost confidence

empowerment

Me: Okay that's really interesting. So just really thinking about the term "working memory". Had you heard about it before?

I have, but not to a huge degree. I kind of just think of it as being not good at remembering everything I suppose! I haven't worked with it particularly before, it's just sort of one of those buzzwords that

heard about WM but not in detail

buzzword

sometimes you hear and it's like "oh yes I should definitely know about that!"

Me: can you remember where abouts you heard it?

Probably in my training three years ago (laughs)

Me; Okay so covered through that?

And through the SEN training and things like that. Discussing different children's needs, it would have come into there. And whether I have used it very much since then, I think is not necessarily as much as I would like to.

constraints for using knowledge

Me: No, but then there are some other buzzwords as well that get thrown around also.

Yes it's like "I can do that one. And that one. Oh that's something that might be in this classroom!' (laughs)

Me: So have you worked here since you have trained?

Yep

Me: Have you ever been on training? Ever had any courses or training that have mentioned working memory at all?

No not particularly.

Me: Okay so obviously you said it's that thing about remembering, what does the term mean to you? If you had to describe it in a sentence, what would it be?

Erm it would be remembering a series of key details to be able to put into their learning.

retention

holding information

Me: Okay.

cognitive load

So one thing they might be able to remember. But when you say this and this and this, that's too much. They can't do that.

Me: It's kind of the multiple aspects. It's not just one instruction but when you start adding things up and building it up, it's that combined really?

Yeah and we've been working at the moment on word problems in maths, but multi-step word problems. And one of the girls who I have actually been thinking of, she really struggled yesterday, got really upset with it because she couldn't take all of this information and work out okay how do I get there. There is too much information and I can't process all of that. So then when I gave her just a one step, so you just have to find the one thing to do, she could do it and felt a lot more confident. But when you gave her maybe two or three steps in a problem, she couldn't work out where to start with it.

cognitive load

processing

Me: It's almost like her capacity wasn't it that was just overloaded in that sense?

Yeah

Me: Okay, so have you heard about any other types of memory as well as working memory?

No (laughs) you can teach me those as well!

Me: Erm and what do you think then. You have spoken in maths about multi-step word problems, are there any other tasks you

can think of in the classroom that would draw on working memory?

I think in the way we do our English, they have like a series of top ticks that they need to get into each piece of work. And I think that is something where they might think, well I can do each of these things discreetly. But when you say, now can you use relative clauses, fronted adverbials, complex sentences and modal verbs together, it's something that now remembering how to do any of one of those things is too much. Because there is an overload as you say for their brain to be able to process and I think in our English that can definitely be the case. And also I think as they get older in the school, we do a lot of research. Which again can be one where we have read lots of information, how is pulling out key facts that I think are interesting or important. There is too much to be able to do that from perhaps in those situations as well.

cognitive load

Me: That sort of sifting through and trying to find the other stuff?

Yes

Me: Okay, so is working memory or memory in general something which you think can be improved?

Definitely. Yeah.

Me: What would that look like if you saw? How might you go about that?

Erm, I think…. How would I go about improving memory?

Me: Would you see it as something within the child or?

I think definitely something within the child, there would be more of a confidence and a quicker understanding perhaps of being able to. That's where there will be that slow development of being able to say "okay you couldn't do this. Now we have got a bit more understanding of that." And then over time, they also being able to have strategies to recognise okay this isn't something I am confident with, now I know that I can do this to help me with it. And then over time, each of those strategies coming together into somebody who feels more confident and not even realising they are using those strategies.

develop learner confidence and strategies

empowerment

Me: So training it through giving the child the strategies then like you said? In that respect to increase confidence?

Yeah and then through me just not even necessarily them realising that I have changed something in the way that they are doing their work that helps them. Maybe, I don't know (laughs)

teachers adapt to support

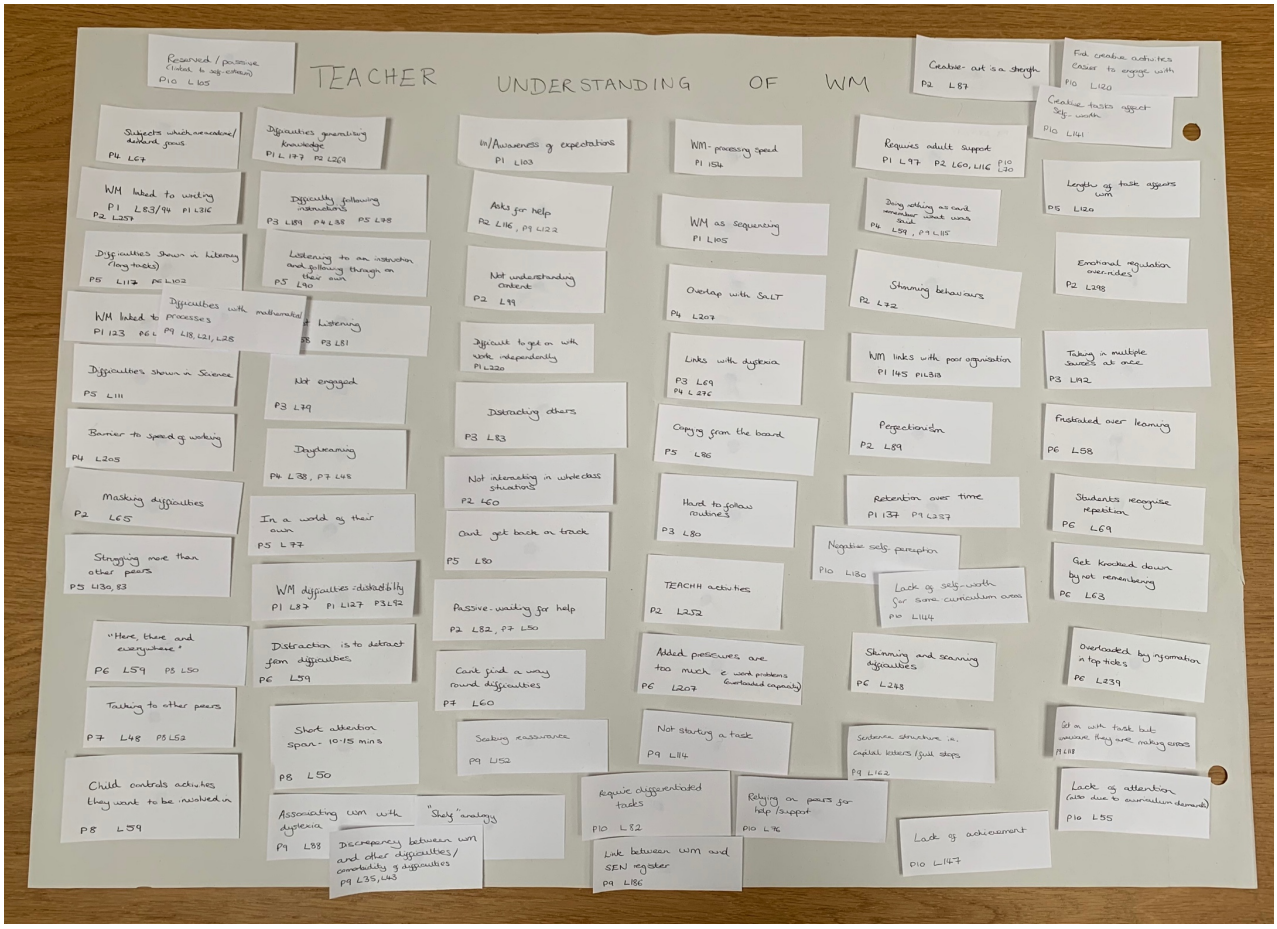
Me: Okay, do you have any kind of measures at school to assess working memory here?

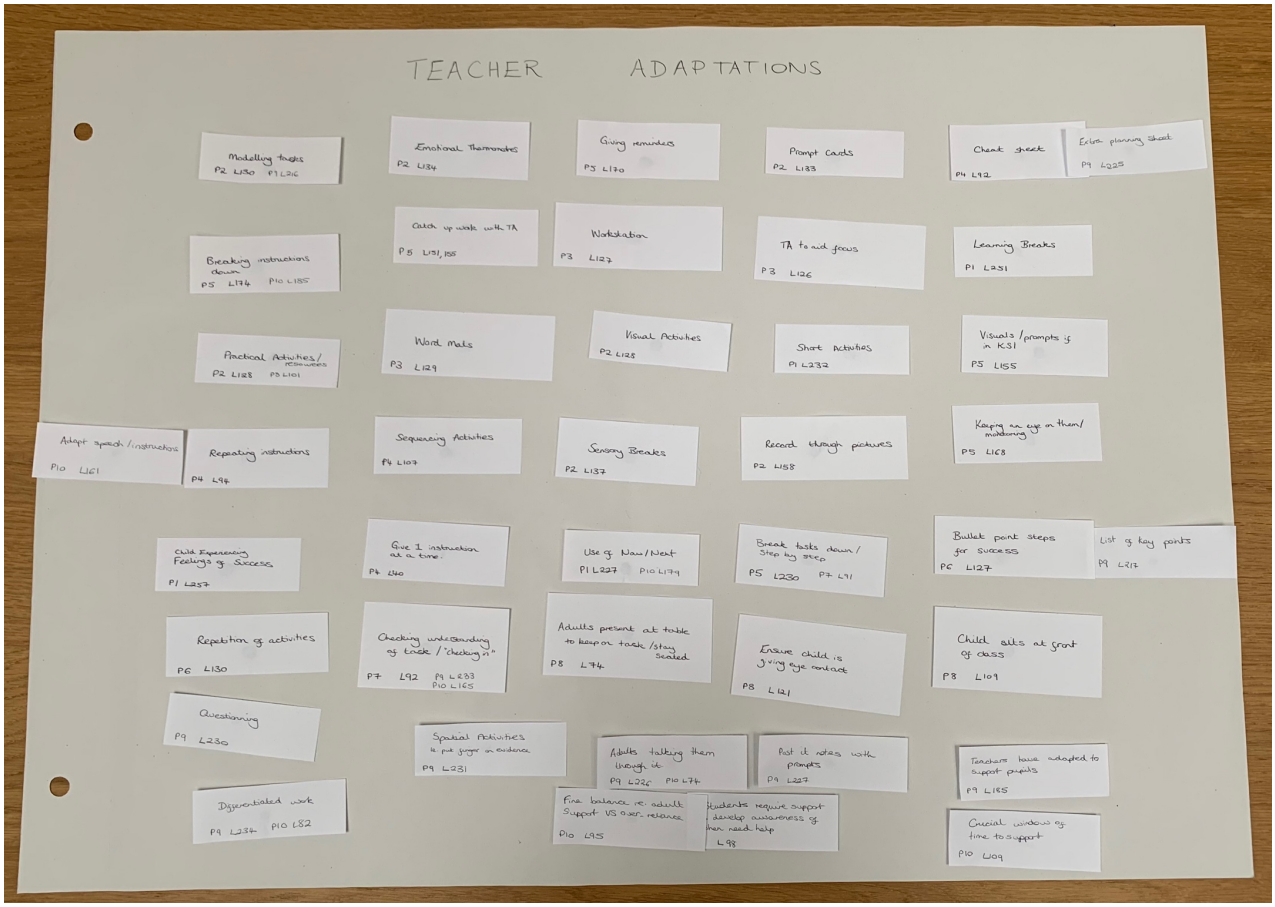
Not really – I haven't used any.

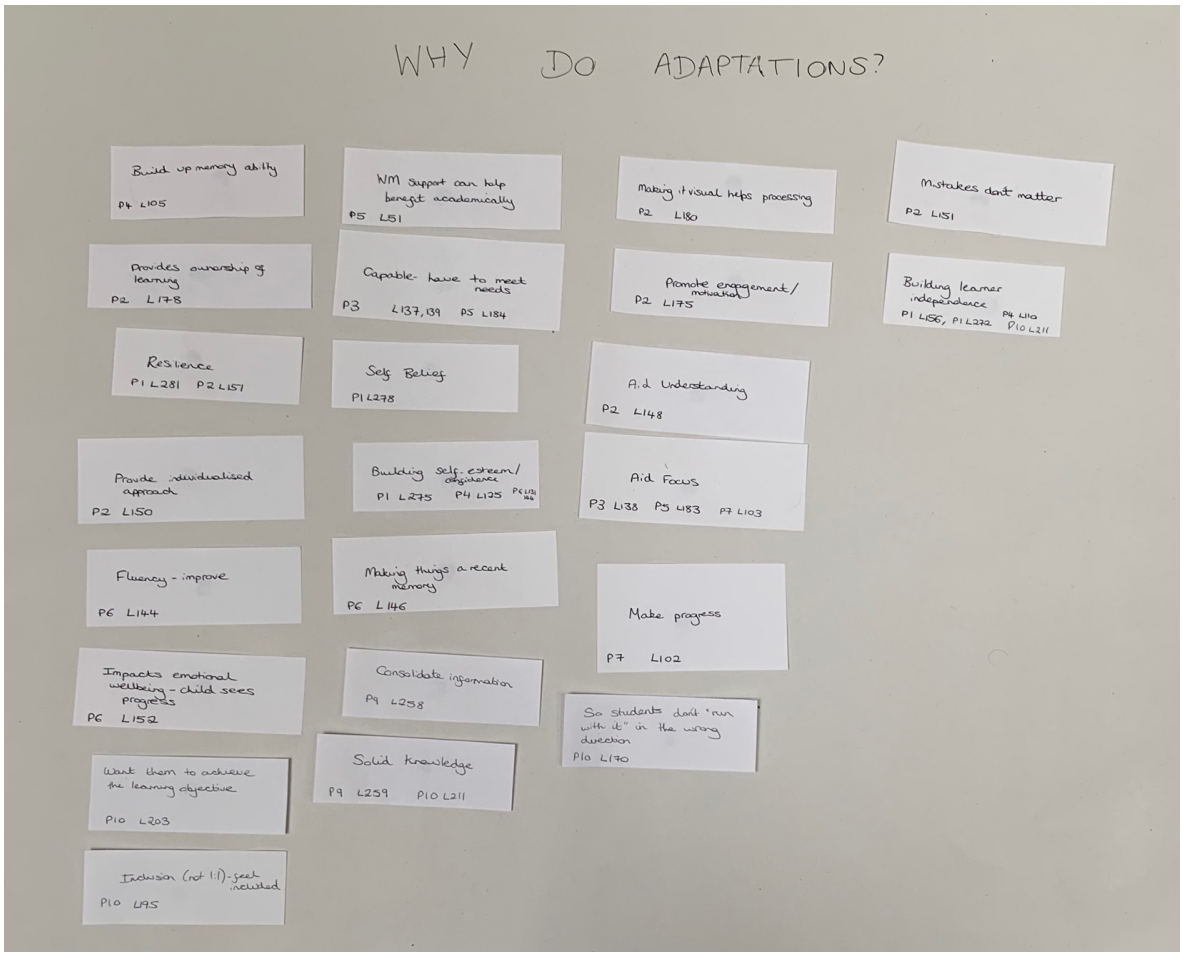
Me: No that's okay. Erm, so just really to sum up, is there anything that you feel we haven't covered in terms of working memory or you wanted to add?

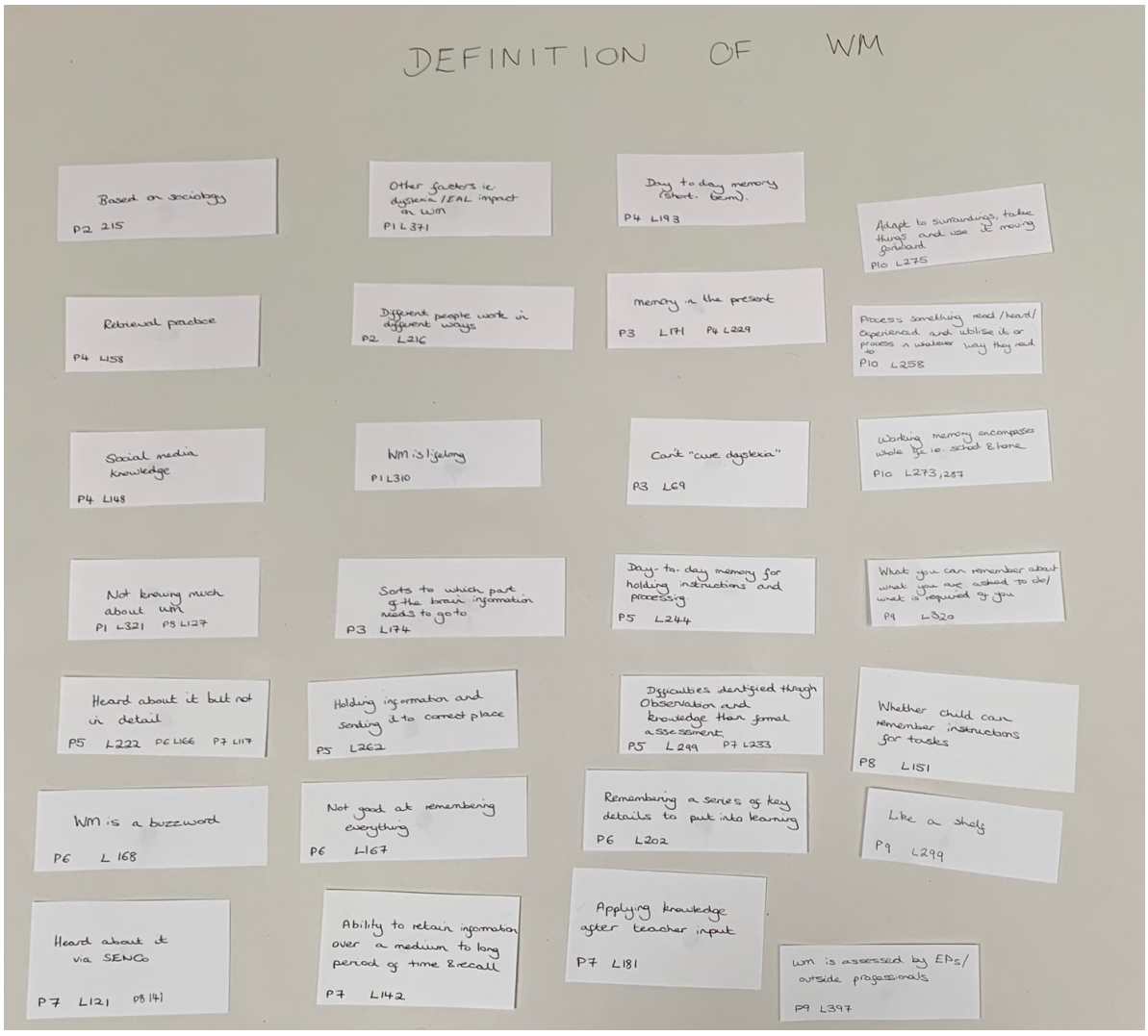
Ermm no I think we are okay. We are okay.

Appendix 8 : Examples of Initial Coding by Areas of Interest

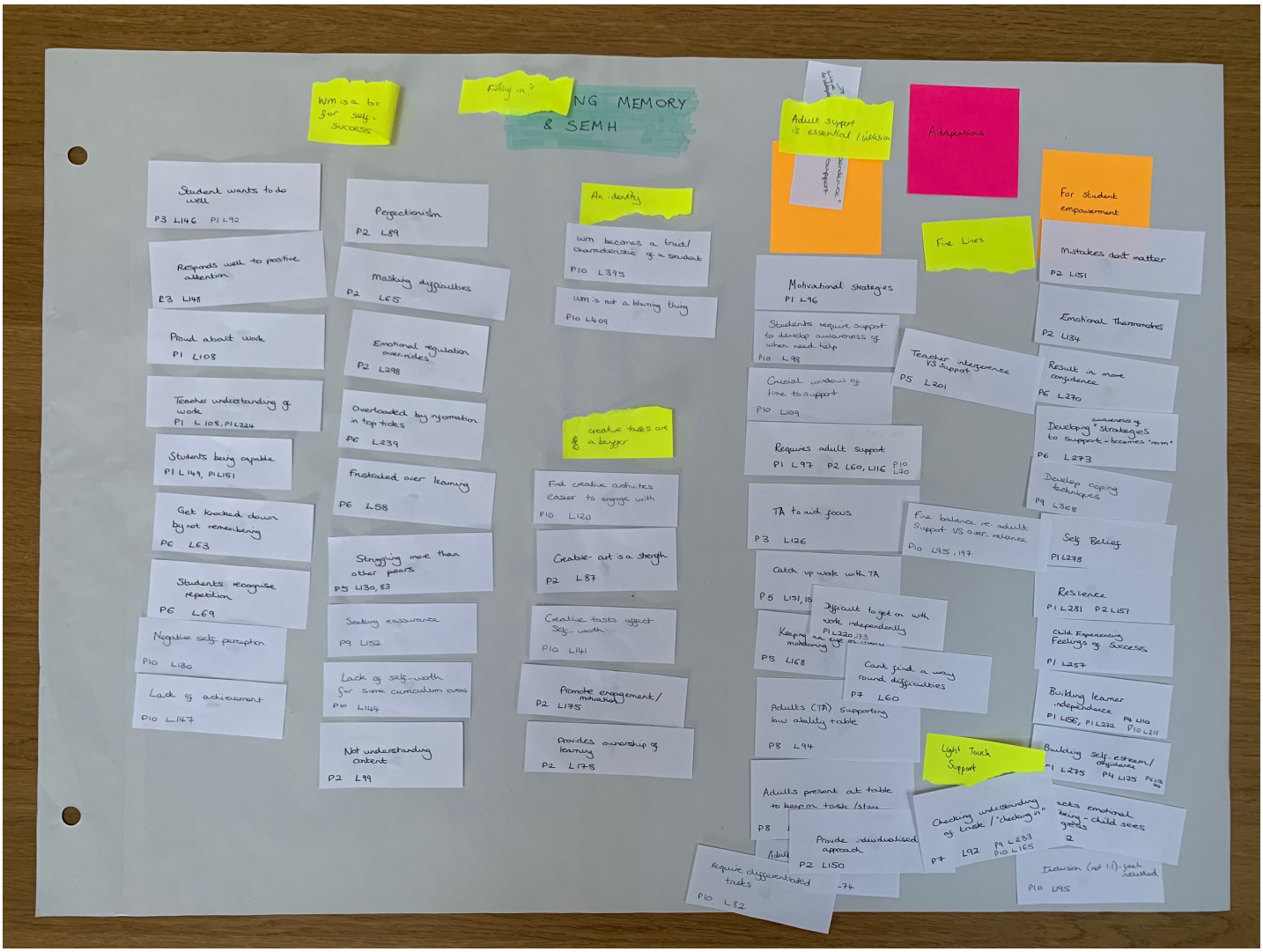


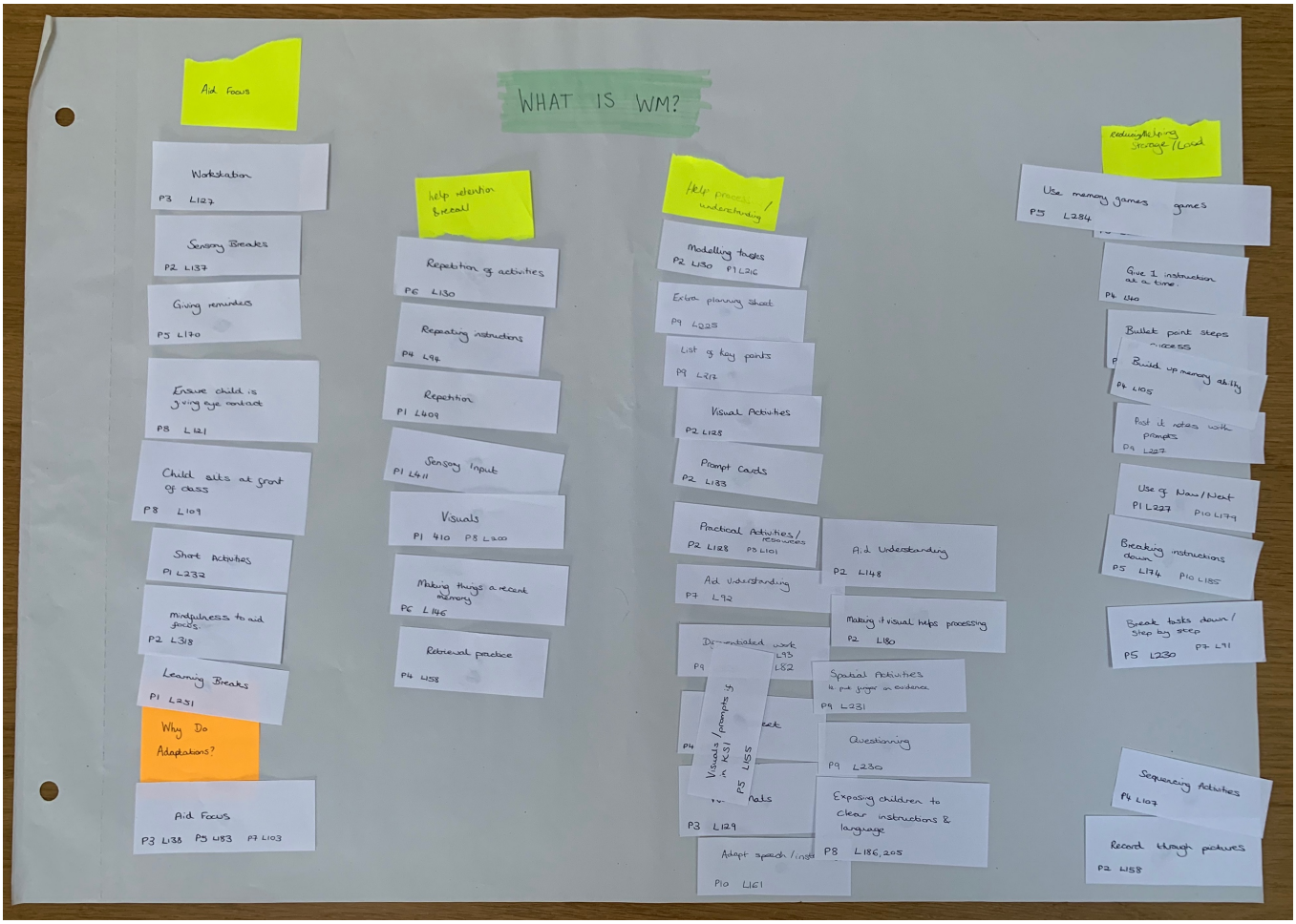


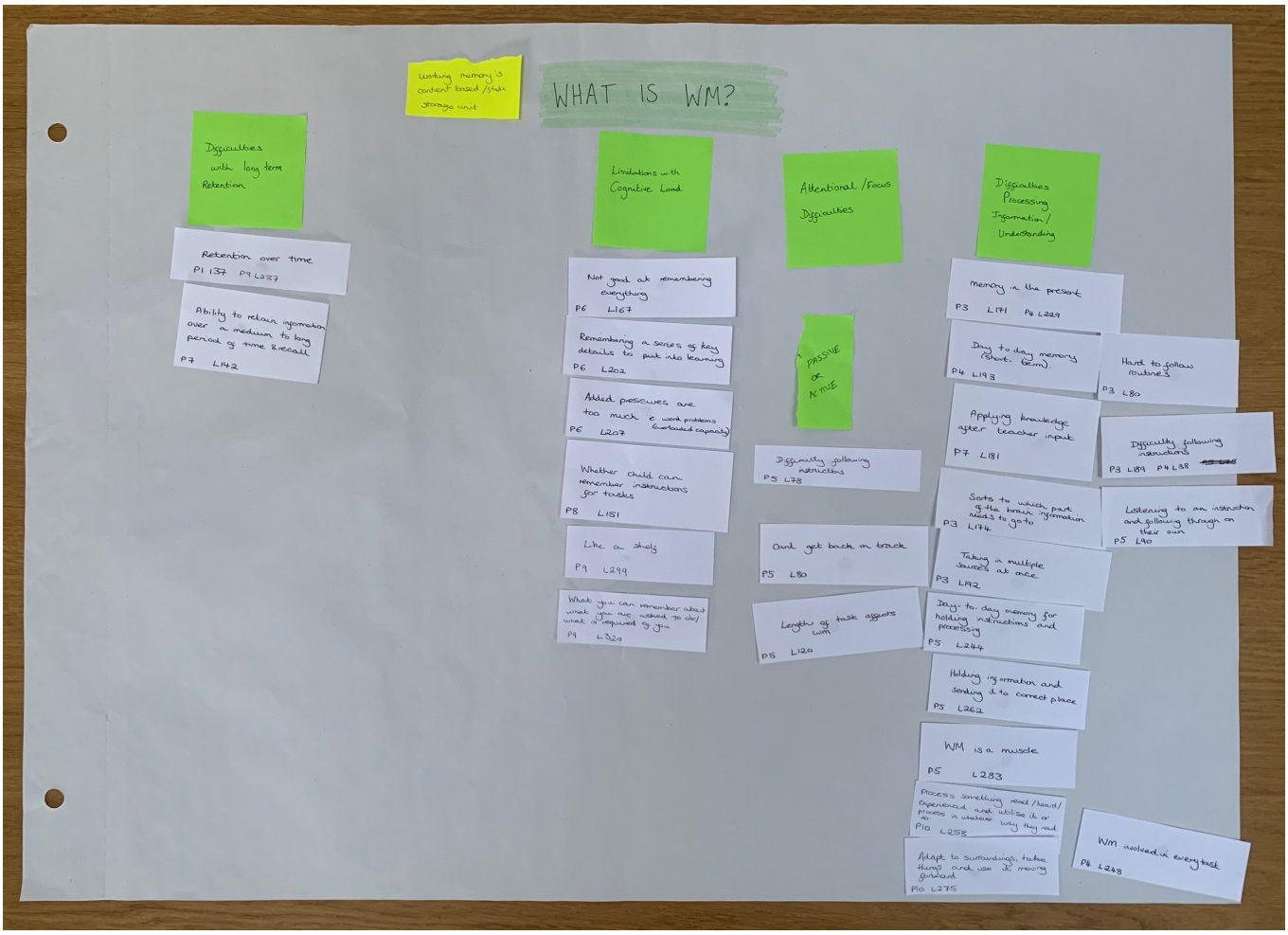

WHY DO ADAPTATIONS?
Build up memory ability
P4 L105
WM support can help benefit academically
P5 L51
Making it visual helps processing
P2 L180
No stakes don't matter
P2 L151
Provides ownership of learning
P2 L178
Capable- have to meet needs
P3 L137, 139 P5 L184
Promote engagement/ motivation
P2 L175
Building learner independence
P1 L156, P1 L272 P4 L110 P10 L211
Resilience
P1 L281 P2 L157
Self Belief
P1 L278
Aid Understanding
P2 L148
Provide individualised approach
P2 L150
Building self esteem/ confidence
P1 L275 P4 L125
Aid Focus
P3 L138 P5 L183 P7 L103
Fluency - improve
P6 L144
Making things a recent memory
P6 L146
Make progress
P7 L102
Impacts emotional wellbeing - child sees progress
P6 L152
Consolidate information
P9 L258
So students don't "run with it" in the wrong direction
P10 L170
Want them to achieve the learning objective
P10 L203
Solid knowledge
P9 L259 P10 L211
Inclusion (not 1:1) - feel included
P10 L95


DEFINITION OF WM
Based on sociology
P2 215
Other factors ie. dyslexia /EAL impact on WM
P1 L371
Day to day memory (short. term).
P4 L193
Adapt to surroundings, take things and use it moving forward
P10 L275
Retrieval practice
P4 L158
Different people work in different ways
P2 L216
memory in the present
P3 L171 P4 L229
Process something read/heard/ experienced and utilise it or process in whatever way they need to
P10 L258
Social media knowledge
P4 L148
WM is lifelong
P1 L310
Can't "cure dyslexia"
P3 L69
Working memory encompasses whole life ie. school & home
P10 L273, 287
Not knowing much about WM
P1 L321 P8 L127
Sorts to which part of the brain information needs to go to
P3 L174
Day-to-day memory for holding instructions and processing
P5 L244
What you can remember about what you are asked to do/ what is required of you
P9 L320
Heard about it but not in detail
P5 L222 P6 L166 P7 L117
Holding information and sending it to correct place
P5 L262
Difficulties identified through Observation and knowledge than formal assessment
P5 L299 P7 L233
Whether child can remember instructions for tasks
P8 L151
WM is a buzzword
P6 L 168
Not good at remembering everything
P6 L167
Remembering a series of key details to put into learning
P6 L202
Like a shelf
P9 L299
Heard about it via SENCo
P7 L121 P8 141
Ability to retain information over a medium to long period of time & recall
P7 L142
Applying knowledge after teacher input
P7 L181
WM is assessed by EPs/ outside professionals
P9 L397

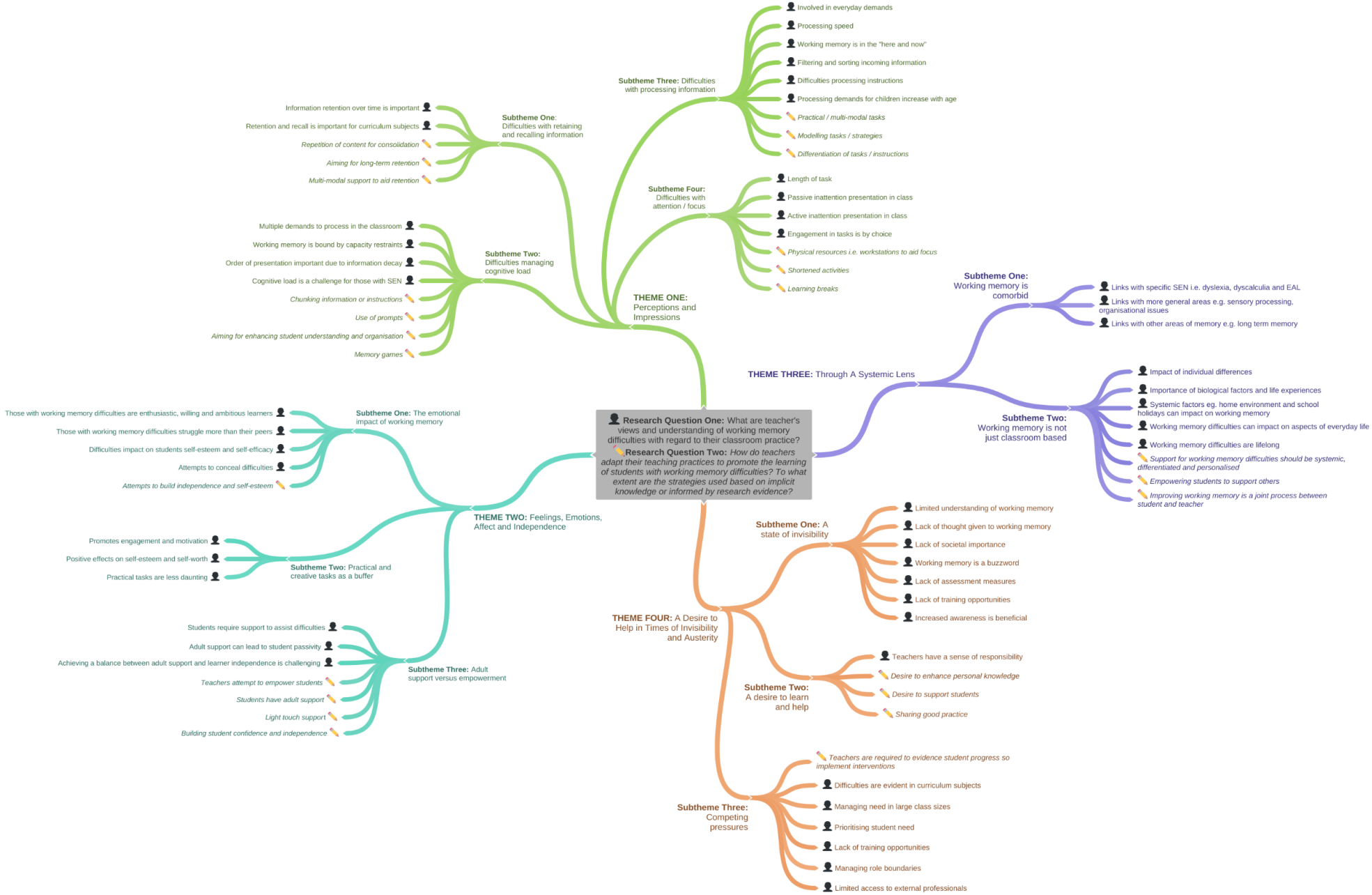
Appendix 9 : Examples of Theme Development From Initial Codes



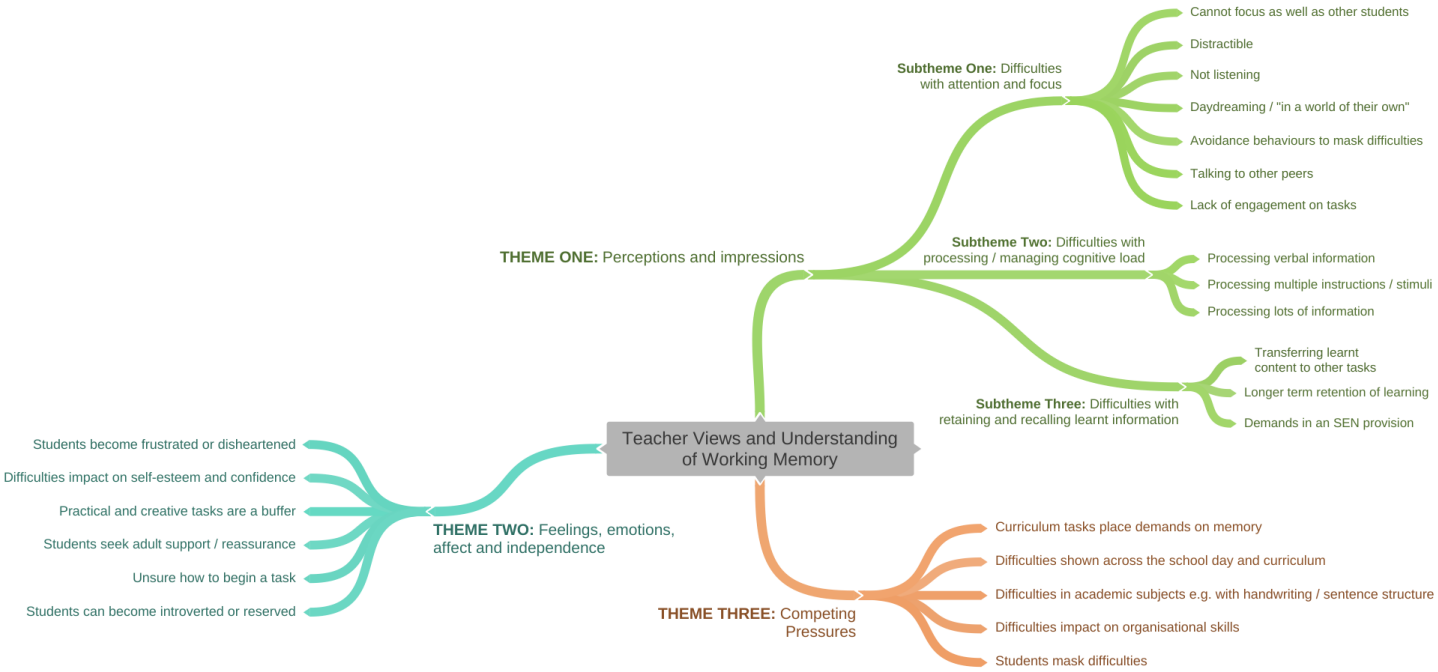

WHAT IS WM?
Aid Focus
Workstation P3 L127
Sensory Breaks P2 L137
Giving reminders P3 L170
Ensure child is giving eye contact P8 L121
Child sits at front of class P8 L109
Short Activities P1 L232
mindfulness to aid focus P2 L318
Learning Breaks P1 L231
Why Do Adaptations?
Aid Focus P3 L138 P5 L183 P7 L103
Help retention & recall
Repetition of activities P6 L130
Repeating instructions P4 L94
Repetition P1 L409
Sensory Input P1 L411
Visuals P1 410 P8 L300
Making things a recent memory P6 L146
Retrieval practice P4 L58
Help processing / understanding
Modelling tasks P2 L130 P1 L216
Extra planning sheet P9 L223
List of key points P9 L217
Visual Activities P2 L128
Prompt Cards P2 L133
Practical Activities/ resources P2 L128 P3 L101
Aid Understanding P7 L92
Differentiated work L45 L82 P9
Visuals / prompts in KS1 P5 L155
Nats P3 L129
Aid Understanding P2 L148
Making it visual helps processing P2 L180
Spatial Activities to put prayer in evidence P9 L231
Questioning P9 L230
Exposing children to clear instructions & language P8 L186, 205
Adapt speech / instr P10 L161
Reducing/Helping Storage / Load
Use memory games P5 L284
Give 1 instruction at a time. P4 L40
Bullet point steps process
Build up memory ability P4 L105
Post it notes with prompts P9 L227
Use of Now/Next P1 L227 P10 L179
Breaking instructions down P5 L174 P10 L185
Break tasks down / Step by step P5 L230 P7 L91
Sequencing Activities P4 L107
Record through pictures P2 L158

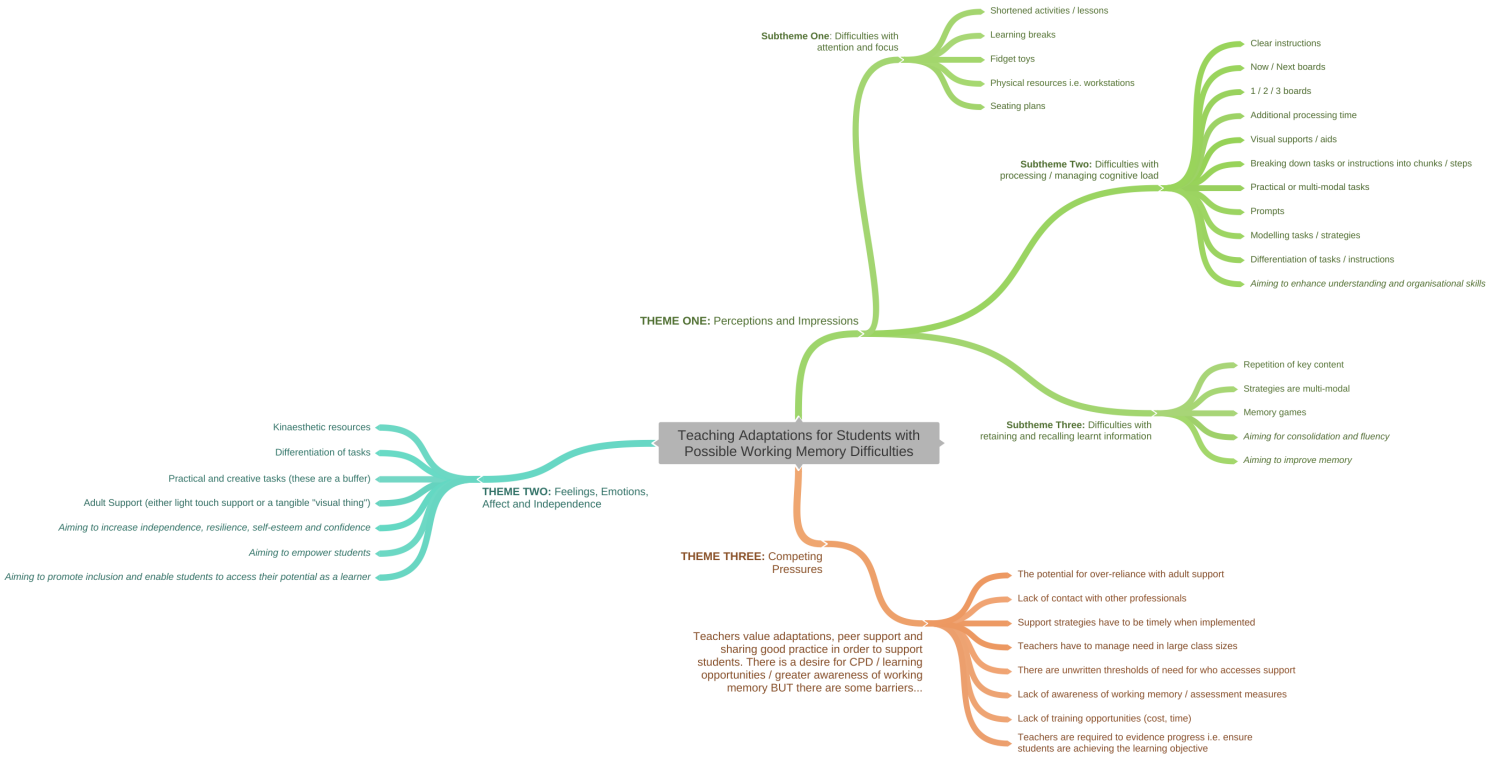

WHAT IS WM?
Working memory is content based/task storage unit
Difficulties with long term Retention
Retention over time P1 137 P9 L227
Ability to retain information over a medium to long period of time & recall P7 L142
Limitations with Cognitive Load
Not good at remembering everything P6 L167
Remembering a series of key details to put into learning P6 L202
Added pressures are too much & word problems (overloaded capacity) P6 L207
Whether child can remember instructions for tasks P8 L151
Like a study P9 L299
What you can remember about what you are asked to do/ what is required of you P4 L329
Attentional / Focus Difficulties
PASSIVE or ACTIVE
Difficulty following instructions P5 L78
Can't get back on track P5 L80
Length of task appears long P5 L120
Difficulties Processing Information / Understanding
memory in the present P3 L171 P4 L229
Day to day memory (short term). P4 L193
Hard to follow routines P3 L80
Applying knowledge after teacher input P7 L181
Difficulty following instructions P3 L189 P4 L38
Sorts to which part of the brain information needs to go to P3 L174
Listening to an instruction and following through on their own P5 L90
Taking in multiple sounds at once P3 L192
Day-to-day memory for holding instructions and processing P5 L244
Holding information and sending it to correct place P5 L262
WM is a muscle P5 L283
Process something read/heard/experienced and utilise it or process it whatever way they need P10 L258
Adapt to surroundings, tackle things and use it moving forward P10 L275
WM involved in everything P4 L243

THEMATIC MAP BEFORE REVISIONS



Appendix 10 : Thematic Maps for Research Questions 1 & 2





Appendix 11 : Completed Copy of the WMRS

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Appendix 12: Information Sheet and Consent Form Sent to Parents

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"Working Memory Friendly Schools"
Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools

Please read this information and return the attached form to your child's class teacher by Monday 16th September 2019.

Dear parent/carer,

A research project is currently taking place at your child's school. This research aims to examine whether Educational Psychologists (EPs) can use coaching psychology techniques with primary school teachers to translate research knowledge about working memory into the classroom in order to benefit children's learning.

Who Is Conducting The Research?

The research is being conducted by Kiera Farrelly, a Trainee Educational Psychologist at the University of Exeter, who has enhanced DBS clearance. I also work part-time in the Educational Psychology Service at XXX. The research project is being supervised by Professor Brahm Norwich at the University of Exeter.

Why Am I Being Contacted?

Your child falls into the age range taking part in this project and has been identified by the class teacher as potentially being eligible to take part in this research.

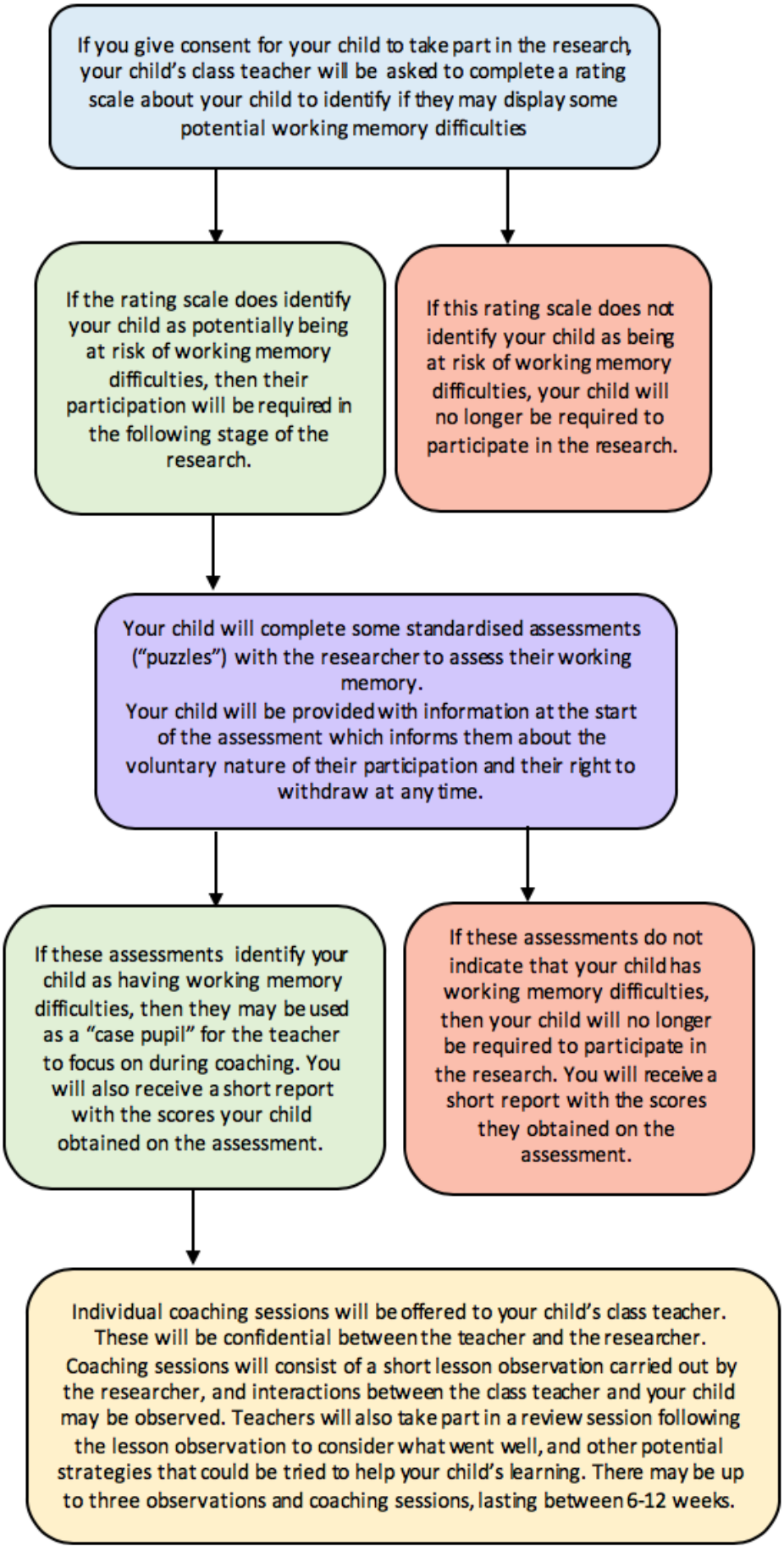
Why Is It Important?

Involvement in the research will be useful for the school as it will help teachers to identify which students may be at risk of working memory difficulties and help to support these students in the classroom.

Benefits of taking part in the research include:

- Early intervention for your child (if their needs warrant intervention and support)
- A personalised report written by a Trainee Educational Psychologist examining your child's working memory (if this stage is undertaken with your child).
- Teacher continued professional development (CPD), if your child's teacher takes part in the coaching phase.

What Does The Research Involve?



Data Protection

All data (rating scales and standardised assessment scores) will be treated confidentially and held in accordance with the Data Protection Act. Teacher coaching discussions will be confidential and only available to the researcher and participating teacher.

Any information provided will be used for research purposes and processed in accordance with current data protection legislation and university guidelines. Your child's personal data will be treated in the strictest confidence and will not be disclosed to any unauthorised third parties.

The rating scale and assessment data will only be accessible to the research team, yourself and school staff, and would only be used with the intention to help support your child and their learning. Once the research is completed (September 2020) the rating scale data will be destroyed. The standardised assessment scores may be retained by school staff for future use on discretion of the school.

What Will Happen With The Results From The Study?

The results of the research will be published in anonymised form.

If your child takes part in the standardised assessments, a short summary report will be produced which will be shared with you and your child's school. Following completion of the research, results from the study may be written up for publication with an aim to better inform the academic literature on how to support children's working memory within schools. If this occurs, all data will be anonymous and your child's name or school information will not be available on any publication.

What Should I Do If I Wish To Take Part?

If you are happy for your child to be involved in this project, please complete the form on the next page and return it by Monday 16th September 2019 to the teacher who sent you this information sheet.

If you would like to discuss this research further, or have any questions or concerns, please email Kiera Farrelly at XXXXXXX.

Parent reply slip:

"Working Memory Friendly Schools": Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools

Please complete this form and return to your child's class teacher by Monday 16th September 2019.

Please tick the appropriate box:

I have read about the research study and understand what is involved. I **do** give consent for my child to take part	I **do not** give consent for my child to take part

Your name:……

Your child's name and year group:……

Signature:……

Date:……

Thank you very much for your help.

"Working Memory Friendly Schools"
Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools

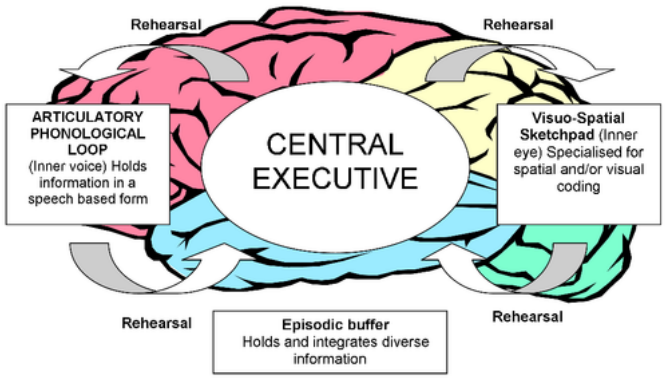
Child: Child A **School: X Primary School**

Following parental consent for Child A to take part in the research, this report is a summary of the work conducted with Child A. This included:

- Individual assessment work with Child A on 10.07.2019 at X Primary School.
- Three coaching sessions with Child A's class teacher where he was a case pupil. During these coaching sessions, strategies to aid Child A's memory were trialled and this report contains a summary of strategies which were beneficial for him.

Summary of Individual Assessment Work with Child A

Working memory research suggests that there are two domains of working memory; an auditory domain and a visual-spatial domain (see image below for more detail). I therefore assessed both Child A's auditory and visual-spatial working memory using sub-tests from the Wechsler Intelligence Scale for Children fifth edition (WISC V) and the Wechsler Non-Verbal Scale of Ability (WNV) in a quiet and distraction free environment. The WISC V and the WNV are standardised tests, meaning that Child A's scores can be compared to others of his exact age to gain an idea of strengths and weaknesses in some of his memory abilities.



Working memory model developed by Baddeley (2000) which details the two aspects of working memory; the verbal aspect ('Phonological Loop') and the visual aspect ('Visuo-Spatial Sketchpad'). These two aspects are controlled by the 'Central Executive' and integrated together by the 'Episodic Buffer.'

As with any assessment, it is important to note that the test scores represent a measure of skills on a particular occasion in comparison to other children of the same age. Scores may be affected by a range of factors (e.g. attention, anxiety, tiredness or motivation) and therefore should be treated with caution and do not represent Child A as a whole or

indicate that he cannot progress beyond these levels. Any results should be looked at in conjunction with other information about the child to consider a holistic picture of a child's learning needs, particularly as working memory difficulties are likely to only form part of their needs.

Test Name	Skills Assessed	T Score *	Percentile**
Digit Span Forwards (WISC V)	This assesses short-term auditory memory (holding auditory / verbal information in mind for a short period of time). The child is required to listen to, and then repeat a sequence of digits that gradually increase in length.		25
Digit Span Backwards (WISC V)	This assesses auditory working memory (holding auditory / verbal information in mind whilst manipulating the information). This sub-test is similar to the Digit Span Forwards subtest described above, but the child is required to listen to a sequence of digits and then repeat these in reverse order. For example, if the child hears 9,4,6,8,2, they would be required to reverse this and state 2,8,6,4,9.		
Digit Span Sequencing (WISC V)	This assesses auditory working memory (holding auditory / verbal information in mind whilst manipulating the information). The child is required to listen to an increasing sequence of numbers and then repeat these in numerical order. For example, in this subtest, if the child hears 9,4,6,8,2, they should state 2,4,6,8,9.		
Letter Number Sequencing (WISC V)	This assesses auditory working memory (holding auditory / verbal information in mind whilst manipulating the information). This test is similar to the Digit Span Sequencing sub-test described above, but the child is required to listen to an increasing sequence of dual numbers and letters and then repeat these in both numerical and alphabetical order. For example, in this subtest, if the child hears 9,B,4,A, they should state 4,9,A,B.		2
Picture Span (WISC V)	This assesses visual short term memory. The child is required to memorise pictures presented and then identify them in correct sequential order from a larger picture array where other 'distractor' pictures are present.		5

Spatial Span Forwards (WNV)	This assesses short-term visual-spatial memory (holding visual-spatial information in mind for a short period of time). The child is required to watch and then copy a sequence of tapped blocks on a board. These sequences gradually increase in length.	62	
Spatial Span Backwards (WNV)	This assesses visual-spatial working memory (holding visual-spatial information in mind whilst manipulating the information). This sub-test is similar to the Spatial Span Forwards subtest described above, but the child is required to watch a sequence of tapped blocks on a board and then repeat these in reverse order.	42	

* T-scores allow us to compare Child A's scores with what we would expect other pupils of his age to achieve on the same tests. The average T score is 50, with scores between 43 and 56 considered to be in the average range. The higher the number the better the performance.
** Percentile scores show how Child A's performance compares to 100 children of his exact age given the same tasks. For example, his percentile score of 25 means that 25% of children his age would score the same or less than him.

The above subtests combine to form additional index scores. These are displayed in the table below:

Index	**Index Score ±**	**T Score ***	**Percentile ****	**Range Descriptor**
Working Memory *(comprised of Digit Span Forwards, Digit Span Backwards, Digit Span Sequencing and Picture Span).*	79		8	Low
Auditory Working Memory *(comprised of Digit Span Forwards, Digit Span Backwards, Digit Span Sequencing and Letter-Number Sequencing).*	78		7	Low
WNV *(comprised of Spatial Span Forwards and Spatial Span Backwards).*		51	53	Average

± The average index score is 100 with scores between 90-109 deemed to fall within the average range. The higher the number the better the performance.

* The average T score is 50, with scores between 43 and 56 considered to be in the average range. The higher the number the better the performance.

** Percentile scores show how Child A's performance compares to 100 children of his exact age given the same tasks. For example, his percentile score of 8 means that 8% of children his age would score the same or less than him.

What These Results Mean For Child A:

Child A's performance on the WNV (Spatial Span Forwards and Spatial Span Backwards sub-tests) was better than most other children his age and suggest that his kinaesthetic and visual working memory ability is an area of relative strength. On this task, there was a statistically significant difference between the Spatial Span Forward subtest and the Spatial Span Backwards subtest, indicating that Child A found it easier to copy a modelled sequence, rather than having to manipulate the information. On the Spatial Span Forwards subtest, Child A was working at a 12-13 year old equivalent and scored in the top 13.5% for his age range.

Child A's performance on the Working Memory Index and Auditory Working Memory Index however, was lower than average. Child A performed better on the Digit Span Forward and Digit Span Backwards tasks than on the Digit Span Sequencing task, suggesting that Child A found it easier to remember and repeat back information (either verbatim or in reverse), rather than ordering or sequencing information. Child A's results on the Letter-Number Sequencing sub-test also provide weight for the hypothesis that sequencing / processing dual forms of information (numbers and letters) was difficult for him.

In sum, the results indicate that Child A's visual-spatial working memory skills are stronger than his auditory working memory skills, and are therefore an area of strength for Child A.

As the inclusion criteria for a child to be a case pupil in the coaching was 'Low Average' or below in any of the index scores, Child A met this threshold and his class teacher undertook individual coaching sessions with myself in the Autumn Term 2019 to trial strategies to aid Child A's memory. Although the details of each coaching session cannot be provided due to confidentiality agreements, a list of strategies which were discussed are listed below:

- It was discussed that due to Child A's strengths with visual-spatial information, modelling or using visual / kinaesthetic resources along auditory instructions or information is likely to assist Child A's difficulties with his auditory working memory. Examples of these that were discussed included:
    - Physical / tactile resources for maths such as Numicon or counters.
    - Sentence strips for writing tasks which Child A needs to organise.
    - Post-it note prompts on the desk.
    - Highlighting different sentences in different colours.

- Child A is likely to benefit from opportunities for repetition and overlearning to ensure that strategies he uses are consistently and accurately applied. To

facilitate this, consideration may be given to pre-teaching content, re-capping previous work, or using precision teaching approaches to build accuracy and fluency of skills.

- As one of Child A's strengths is his language, he should be encouraged to use this to assist his learning and retention. For example, it was discussed that this may include asking Child A to re-read written work aloud to develop his punctuation skills and drawing attention to this i.e. "Child A I noticed you paused for breath there. Do you think that might suggest we need a full stop?" Additionally, encouraging Child A to link his learning to the real world is likely to make it meaningful and more memorable for him. This was evident in my individual work with Child A where he informed me that one of the tasks "looks like dice." On this subtest, Child A linked it to dice and performed well.

- As Child A is aware of strategies which can aid his learning i.e. using fingers to assist his counting skills, discussion surrounding these strategies should be encouraged. To begin with, successful strategies should be highlighted to Child A i.e. "Child A, this task is similar to the task last week. I think using X helped you then." Over time, Child A should then gradually be encouraged to independently think about resources or strategies which assisted his learning, and discussions with teaching staff regarding what strategies are most helpful should take place.

- Child A is a motivated and keen learner, and during the assessment work, he was able to self-correct himself if he was aware he made a mistake. However, his motivation and enthusiasm sometimes resulted in impulsiveness in some tasks, as he wished to begin the task before I had finished explaining what he was required to do. As such, Child A would benefit from someone 'checking in' and ensuring he has understood the task and what he is required to do before he begins his work. It was also discussed that at times, whilst Child A's motivation and keenness should be built upon, it can sometimes result in him wishing to please and therefore complying with instructions, rather than waiting or asking what to do if he is unsure.

- It was discussed that Child A can find it difficult to sequence details when writing e.g. sentence structure or using capital letters / full stops. Consideration may be given to using Key Stage One literacy games or a word processor to assist with recording information as this may also draw Child A's attention to any mistakes he may make. Additionally, consideration may be given to reducing the cognitive demands of a task and initially allowing a member of staff to scribe for Child A whilst he formulates his ideas. It was noted that this goal is likely be a longer-term goal for Child A and any successful strategies should be built upon.

- As Child A's auditory working memory ability is lower, strategies such as using technology to help reduce the memory load were discussed. For example, this may include Child A using a Talking Postcard or using a Dictaphone to verbally record his ideas before writing them down one sentence at a time and playing back the recording as needed.

- ‘Memory friendly classroom strategies’ such as reducing distraction, presenting information in chunks / small amounts, and providing additional time to process and write information may be helpful.

- Other general memory strategies recommended by Gathercole and Alloway (2008) may be helpful (these are detailed below).

Classroom working memory strategies recommended by Gathercole & Alloway (2008):

- Recognising and monitoring working memory difficulties. Signs that a child may struggle with their working memory include; incomplete recall of information, forgetting instructions, place-keeping errors, missing out chunks of content, task abandonment or appearing inattentive.

- Consider the working memory demands of tasks. Tasks that require multiple elements i.e. following lengthy instructions or completing multi-step tasks may be difficult for a child with working memory difficulties. If a child is struggling with such demands, then reducing memory load may be needed. This may include:

    - Frequent repetition of key information and instructions.
    - Reduce processing demands by breaking down tasks or instructions into smaller chunks and using simple grammar.
    - Reducing content by shortening sentences or reducing the number of items to be recorded.
    - Make available and encourage the use of memory aids i.e. visuals, counters, Numicon, number lines, Dictaphones or classroom displays.
    - Giving the child alternative ways to record their work if possible i.e. through photographs rather than writing.
    - Encourage the child to highlight key words in the text. The first sentence in a paragraph usually contains key facts about subsequent information.
    - Keep external distractions to a minimum.
    - Back up verbal information in a visual format i.e. write steps on the board when giving instructions, draw pictures or create mind-maps.

- Review content from previous lessons.

- Provide a visual example so the child knows what successful task completion looks like.

- Support the use of a personal diary / organiser if needed.

- Encourage the child to identify helpful strategies to aid their memory. This may include:

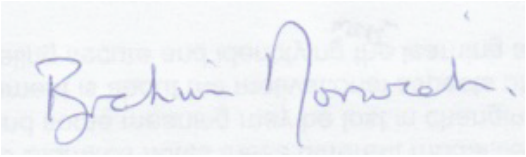
    - Asking the child to repeat what they have heard or have to do in order to aid recall. For example, they may tell you or a peer what they are required to do next in their work.

- Encouraging the child to ask for help when necessary.
- Asking the child what helps them to best recall, retain and process information.
- Creating songs / rhymes / mnemonics to aid recall of learning.

Thank you for allowing Child A to take part in this research. Please feel free to contact me if you have any questions about the report or the results.

Completed by:

Kiera Farrelly
Trainee Educational Psychologist
Date: 17.02.2020



Countersigned by Supervisor, Professor Brahm Norwich (Professor of Educational Psychology and Special Educational Needs at the University of Exeter)

Appendix 14: SPSS Output

```
DESCRIPTIVES VARIABLES=wmrs_percentile wmrs_score wmrs_t_score
  /STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
wmrs_percentile	21	1.00	43.00	10.8571	9.59836	1.987	.501	5.413	.972
wmrs_score	21	17	51	38.24	8.665	-.751	.501	.186	.972
wmrs_t_score	21	52	77	65.90	5.890	-.442	.501	.256	.972
Valid N (listwise)	21								

```
DESCRIPTIVES VARIABLES=wmrs_percentile wmrs_score wmrs_t_score
  /STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
wmrs_percentile	19	1.00	19.00	8.6316	5.83296	.576	.524	-.833	1.014
wmrs_score	19	28	51	40.00	6.839	-.384	.524	-.714	1.014
wmrs_t_score	19	59	77	67.05	4.790	.055	.524	-.323	1.014
Valid N (listwise)	19								

```
DESCRIPTIVES VARIABLES=wisc_wm_percentile wisc_wm_index_score wisc_wm_t_score
  /STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
wisc_wm_percentile	19	.10	95.00	29.2263	31.68215	1.013	.524	-.303	1.014
wisc_wm_index_score	19	45	125	84.79	22.634	-.184	.524	-.464	1.014
wisc_wm_t_score	19	14	67	39.66	14.996	-.123	.524	-.468	1.014
Valid N (listwise)	19								

```
DESCRIPTIVES VARIABLES=wisc_wm_percentile wisc_wm_index_score wisc_wm_t_score
  /STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
wisc_wm_percentile	11	.10	21.00	7.6636	8.47340	.696	.661	-1.236	1.279
wisc_wm_index_score	11	45	88	70.27	16.193	-.557	.661	-1.125	1.279
wisc_wm_t_score	11	14	42	30.05	10.598	-.490	.661	-1.175	1.279
Valid N (listwise)	11								

```
DESCRIPTIVES VARIABLES=wisc_awm_percentile wisc_awm_index_score wisc_awm_t_score
  /STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
wisc_awm_percentile	11	.10	81.00	21.0455	25.29258	1.544	.661	2.257	1.279
wisc_awm_index_score	11	45	113	80.27	19.566	-.208	.661	-.231	1.279
wisc_awm_t_score	11	14	58	36.50	12.867	-.187	.661	-.258	1.279
Valid N (listwise)	11								

```
DESCRIPTIVES VARIABLES=wisc_awm_percentile wisc_awm_index_score wisc_awm_t_score
  /STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
wisc_awm_percentile	8	.10	23.00	8.8125	9.90591	.744	.752	-1.396	1.481
wisc_awm_index_score	8	45	89	72.25	15.655	-.579	.752	-.568	1.481
wisc_awm_t_score	8	14	42	31.19	10.205	-.584	.752	-.629	1.481
Valid N (listwise)	8								

```
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  /COMPRESSED.
GET
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DATASET NAME DataSet2 WINDOW=FRONT.
DATASET ACTIVATE DataSet1.
DATASET ACTIVATE DataSet1.
```

```
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    '(Revised).sav'
  /COMPRESSED.
DESCRIPTIVES VARIABLES=wnv_percentile wnv_t_score
  /STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
```

Descriptives

[DataSet1] /Users/Kiera/Desktop/SPSS Files & Outputs/RQ3 Analysis Full WISC & WNV Data (Revised).sav

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
wnv_percentile	16	.10	95.00	35.6438	34.39418	.477	.564	-1.155	1.091
wnv_t_score	16	17	66	42.00	15.650	-.159	.564	-.939	1.091
Valid N (listwise)	16								

```
DESCRIPTIVES VARIABLES=wnv_percentile wnv_t_score
  /STATISTICS=MEAN STDDEV MIN MAX KURTOSIS SKEWNESS.
```

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
wnv_percentile	7	.10	8.00	2.9000	3.14006	.637	.794	-1.078	1.587
wnv_t_score	7	17	36	27.00	8.042	-.242	.794	-2.405	1.587
Valid N (listwise)	7								

```
EXAMINE VARIABLES=wmrs_t_score wisc_wm_t_score wisc_awm_t_score wnv_t_score
  /PLOT HISTOGRAM NPPLOT
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING PAIRWISE
  /NOTOTAL.
```

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
wmrs_t_score	19	100.0%	0	0.0%	19	100.0%
wisc_wm_t_score	19	100.0%	0	0.0%	19	100.0%
wisc_awm_t_score	11	57.9%	8	42.1%	19	100.0%
wnv_t_score	16	84.2%	3	15.8%	19	100.0%

Descriptives

			Statistic	Std. Error
wmrs_t_score	Mean		67.05	1.099
	95% Confidence Interval for Mean	Lower Bound	64.74	
		Upper Bound	69.36	
	5% Trimmed Mean		66.95	
	Median		67.00	
	Variance		22.942	
	Std. Deviation		4.790	
	Minimum		59	
	Maximum		77	
	Range		18	
	Interquartile Range		7	
	Skewness		.055	.524
	Kurtosis		-.323	1.014
wisc_wm_t_score	Mean		39.66	3.440
	95% Confidence Interval for Mean	Lower Bound	32.43	
		Upper Bound	46.89	
	5% Trimmed Mean		39.59	
	Median		42.00	
	Variance		224.890	
	Std. Deviation		14.996	
	Minimum		14	
	Maximum		67	
	Range		54	
	Interquartile Range		20	
	Skewness		-.123	.524
	Kurtosis		-.468	1.014
wisc_awm_t_score	Mean		36.50	3.879
	95% Confidence Interval for Mean	Lower Bound	27.86	
		Upper Bound	45.14	
	5% Trimmed Mean		36.58	
	Median		39.00	
	Variance		165.550	
	Std. Deviation		12.867	
	Minimum		14	
	Maximum		58	
	Range		45	
	Interquartile Range		19	
	Skewness		-.187	.661
	Kurtosis		-.258	1.279
wnv_t_score	Mean		42.00	3.913
	95% Confidence Interval for Mean	Lower Bound	33.66	
		Upper Bound	50.34	
	5% Trimmed Mean		42.06	
	Median		45.00	
	Variance		244.933	
	Std. Deviation		15.650	
	Minimum		17	
	Maximum		66	
	Range		49	
	Interquartile Range		22	
	Skewness		-.159	.564
	Kurtosis		-.939	1.091

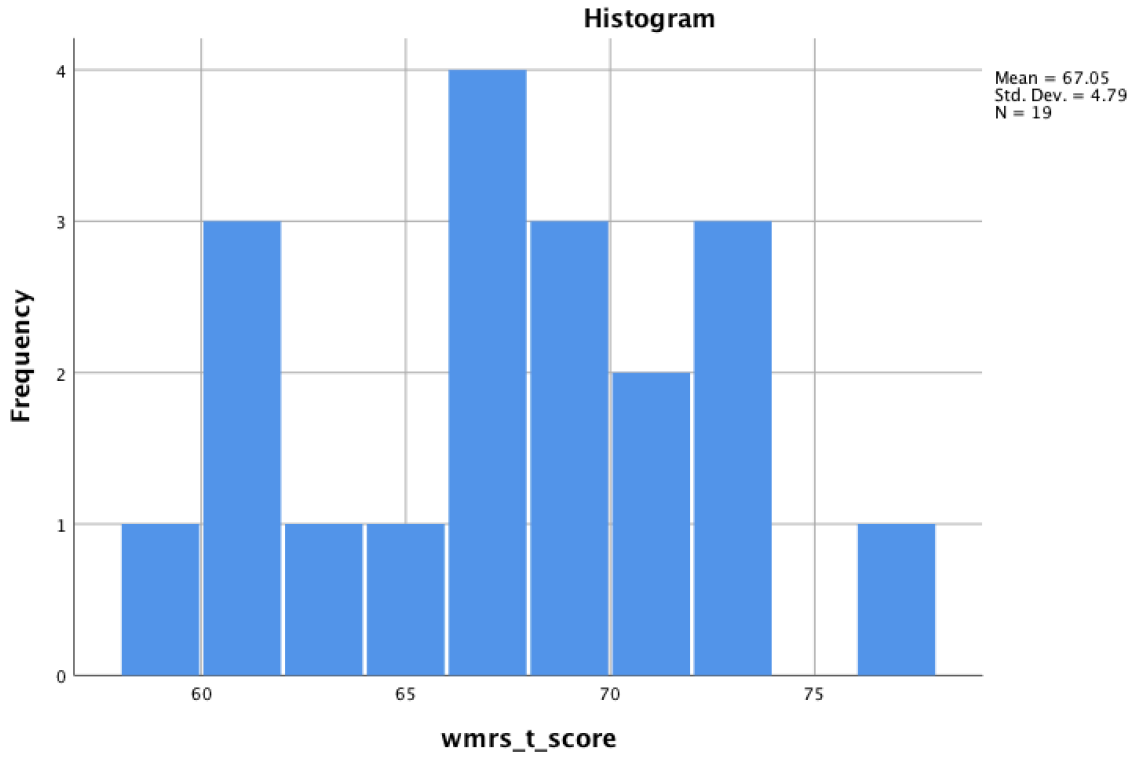
Tests of Normality

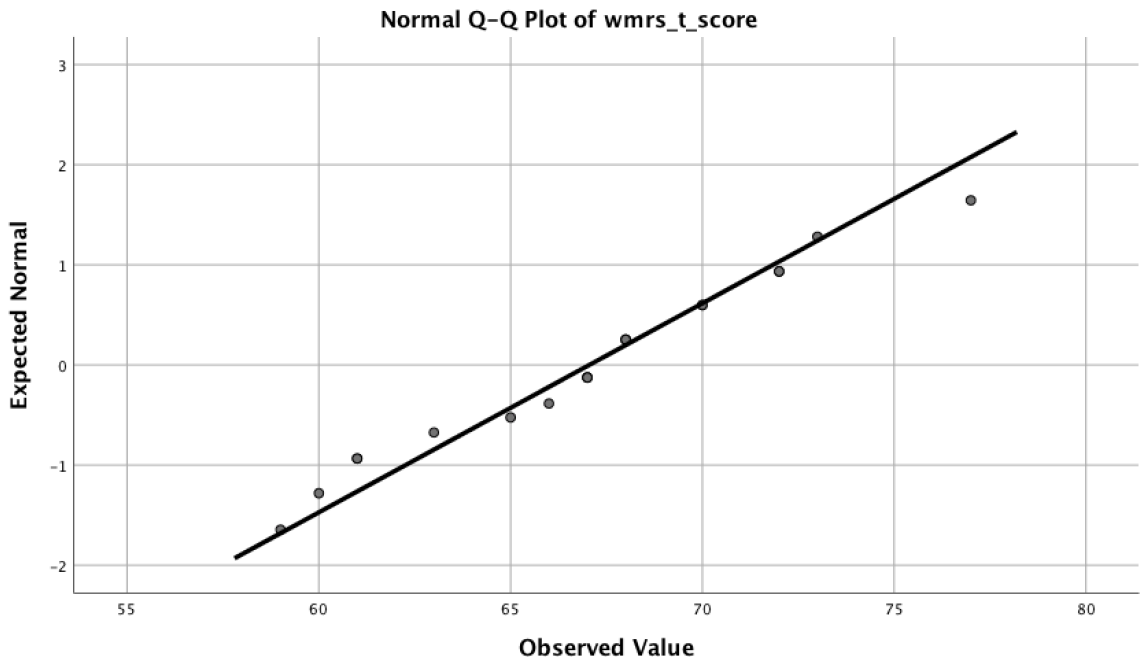
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
wmrs_t_score	.127	19	.200*	.968	19	.745
wisc_wm_t_score	.102	19	.200*	.970	19	.776
wisc_awm_t_score	.122	11	.200*	.985	11	.986
wnv_t_score	.139	16	.200*	.944	16	.404

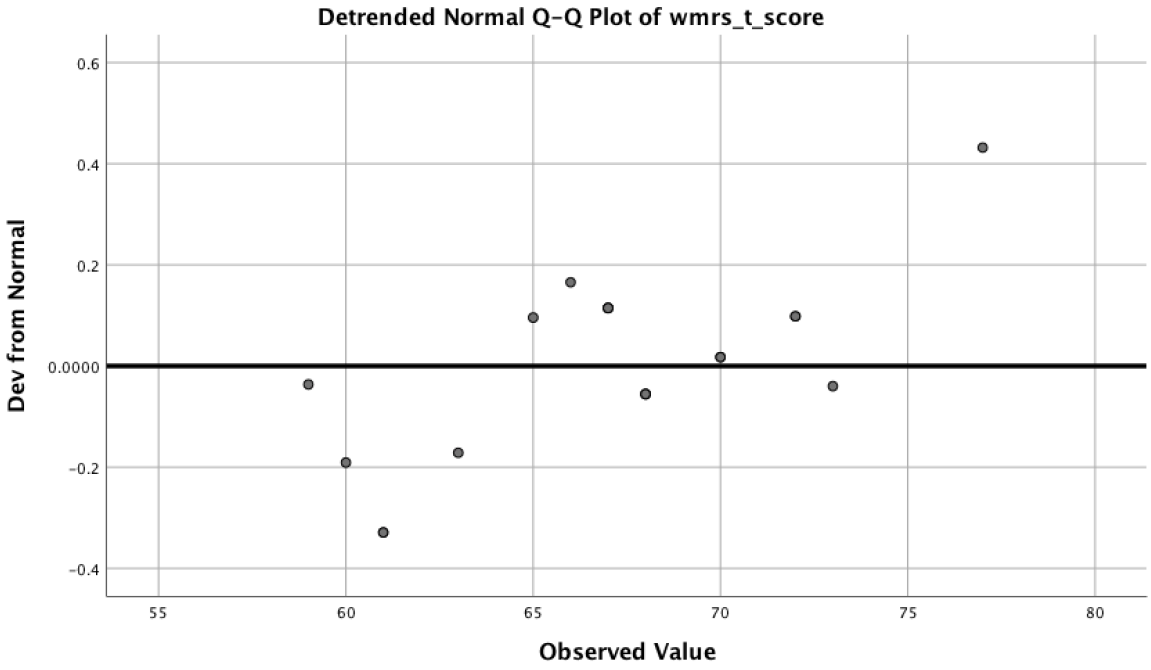
*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

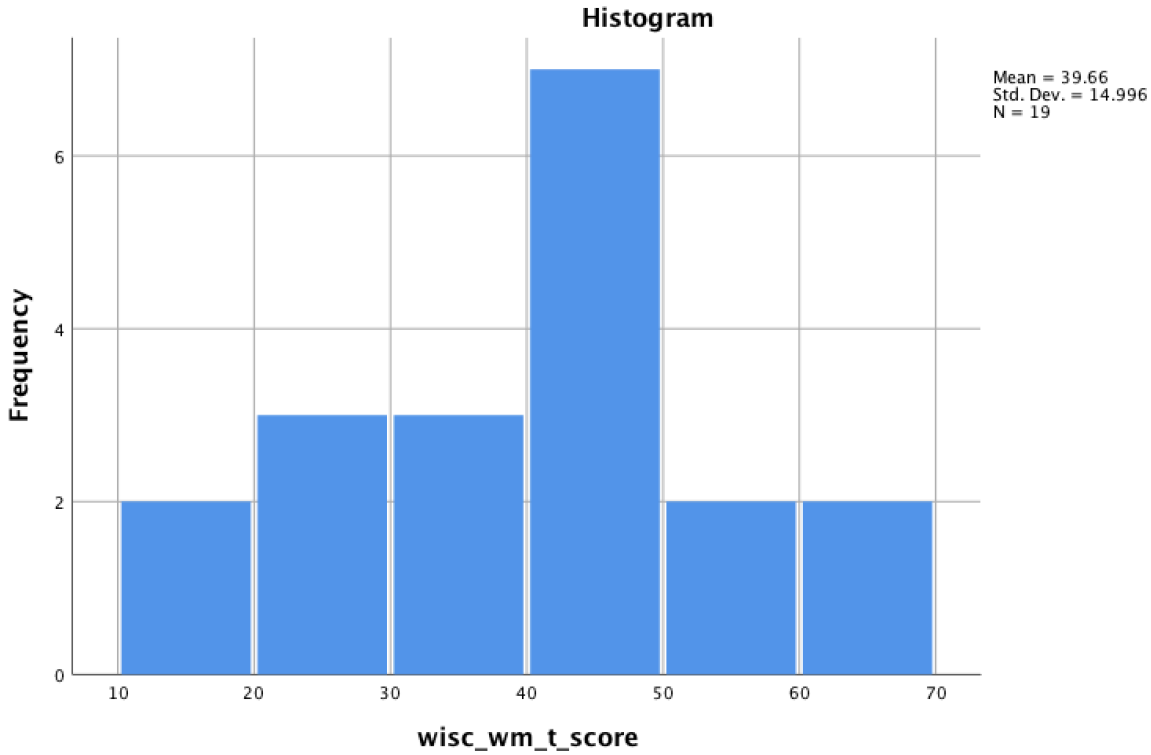
wmrs_t_score

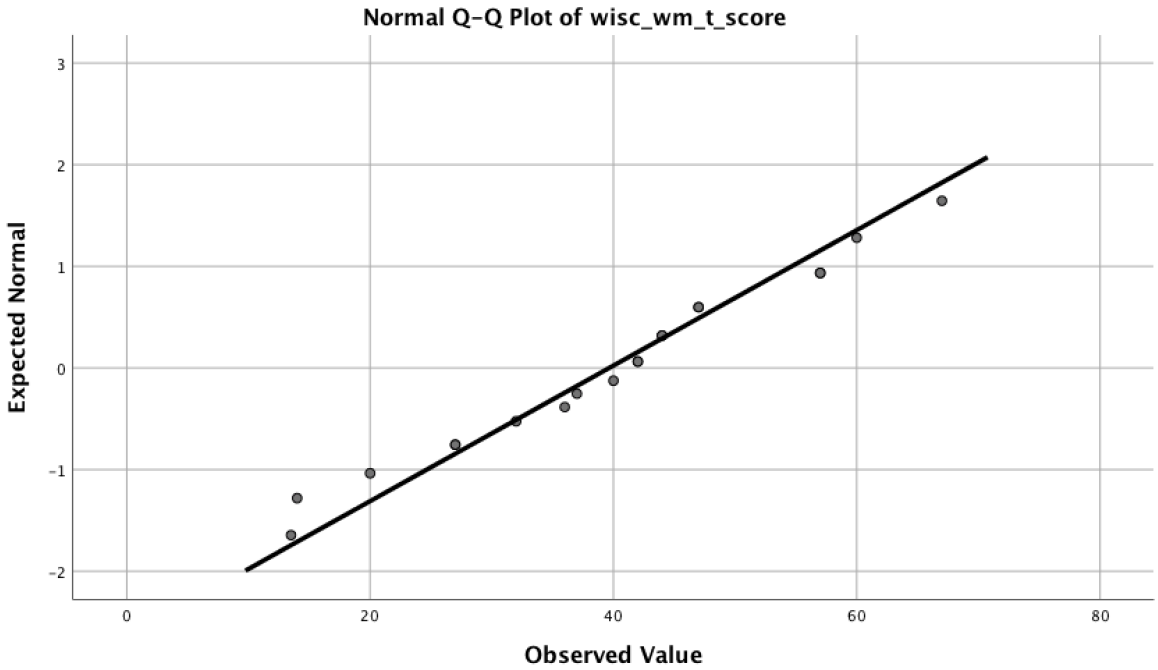


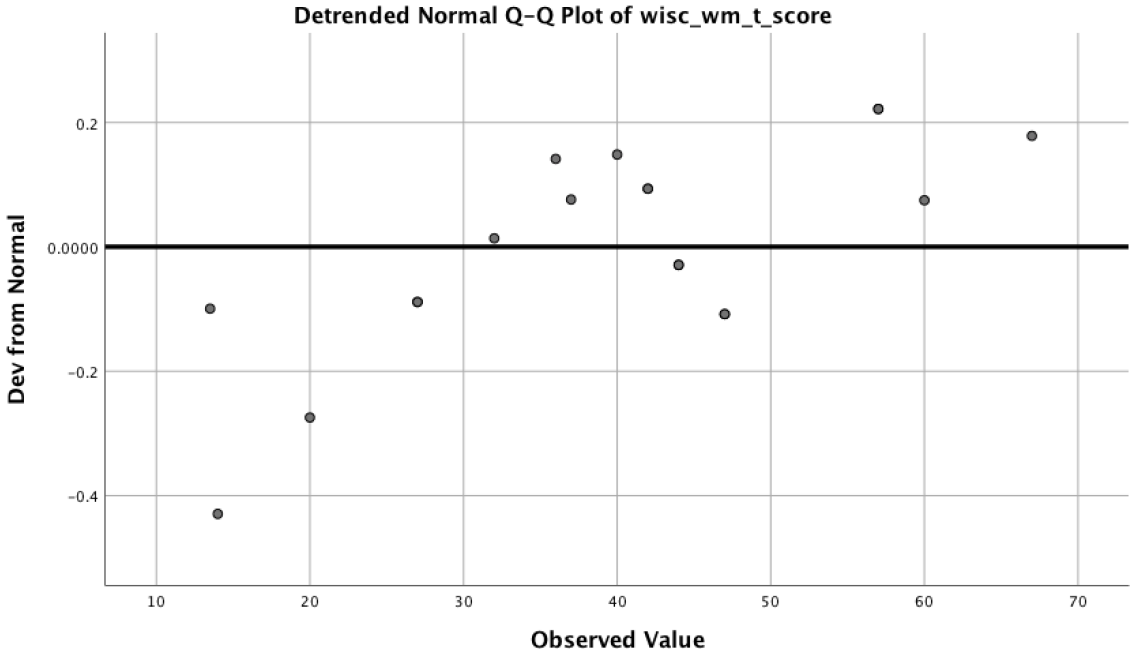

Normal Q-Q Plot of wmrs_t_score
Expected Normal
Observed Value
3
2
1
0
-1
-2
55
60
65
70
75
80


Detrended Normal Q-Q Plot of wmrs_t_score
Dev from Normal
Observed Value
0.6
0.4
0.2
0.0000
-0.2
-0.4
55
60
65
70
75
80

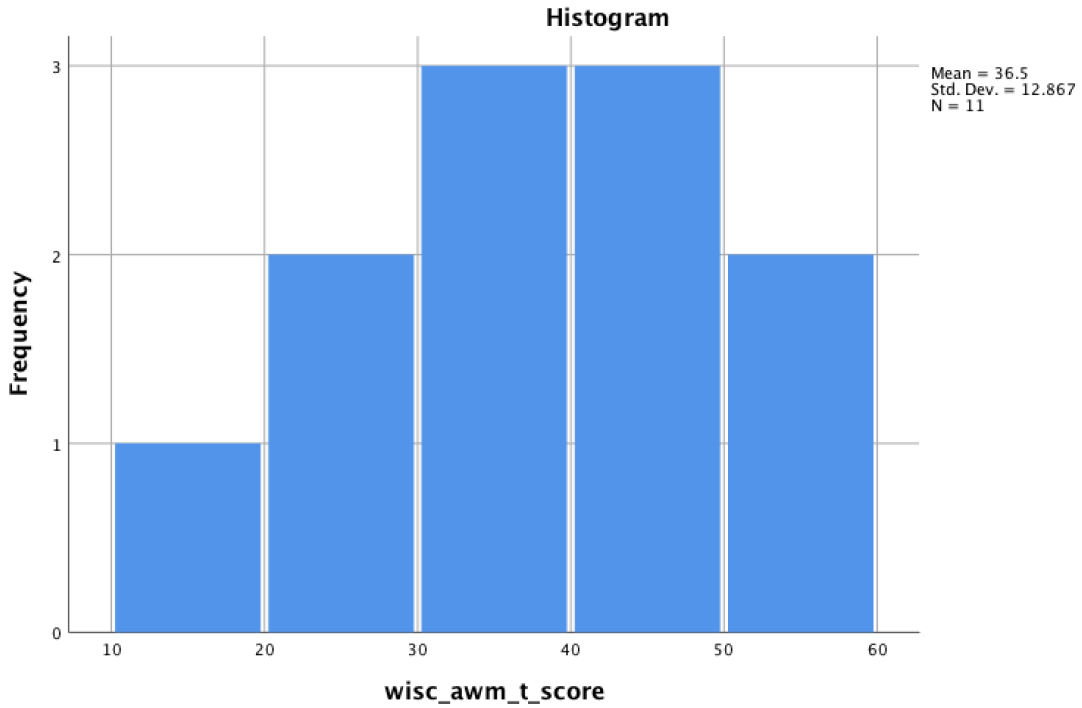
wisc_wm_t_score

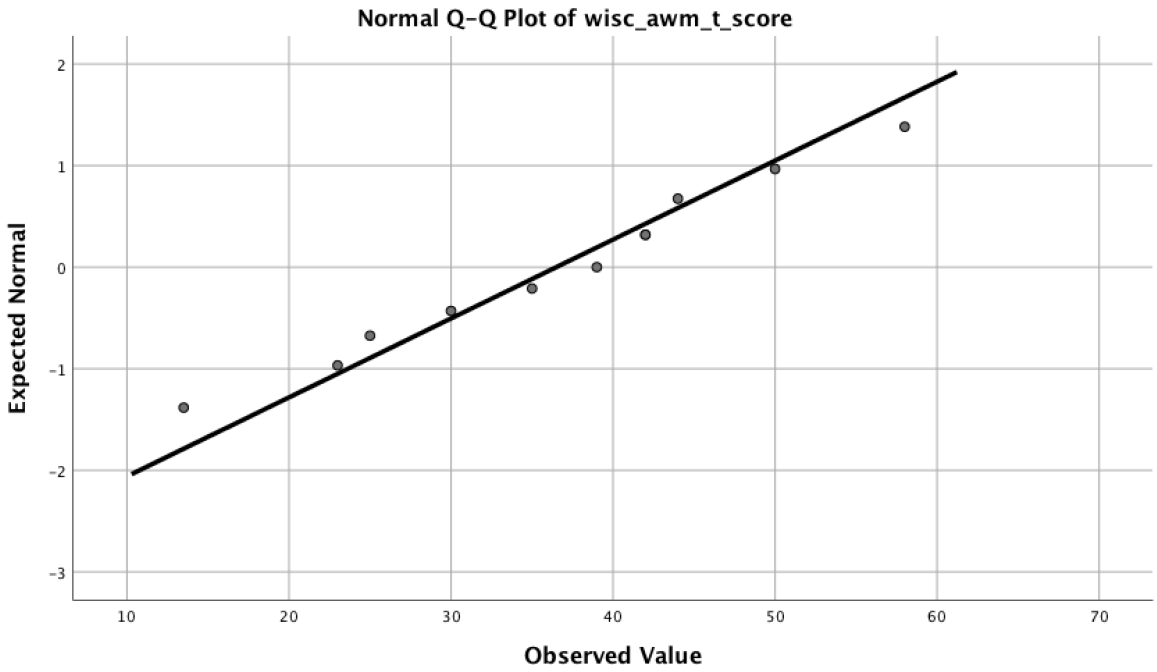


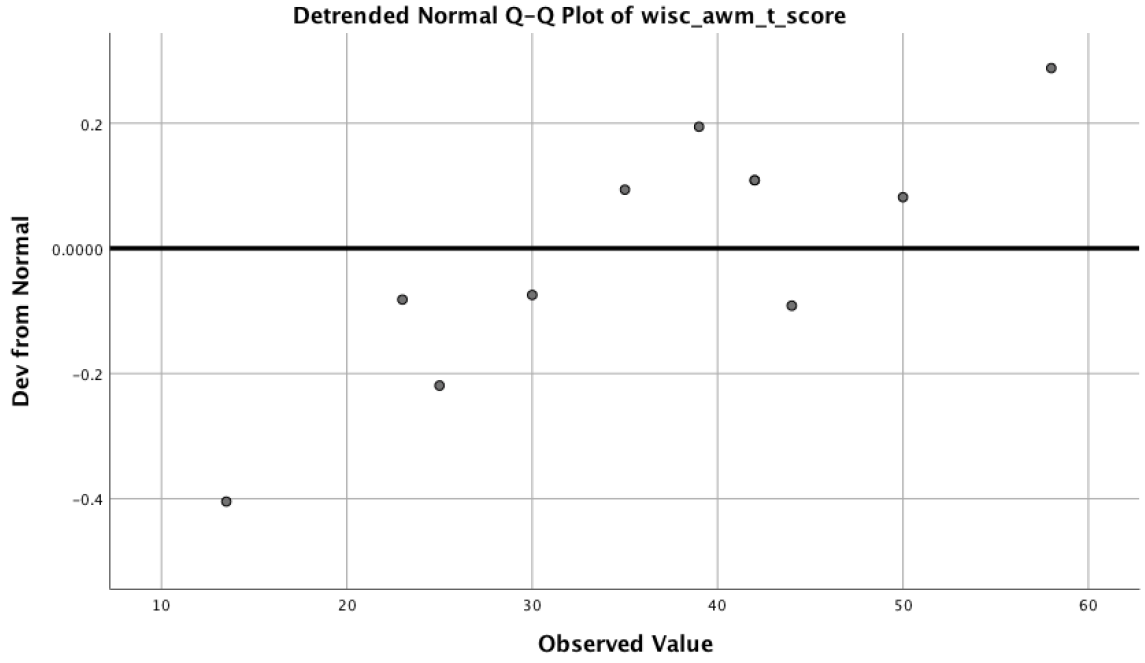




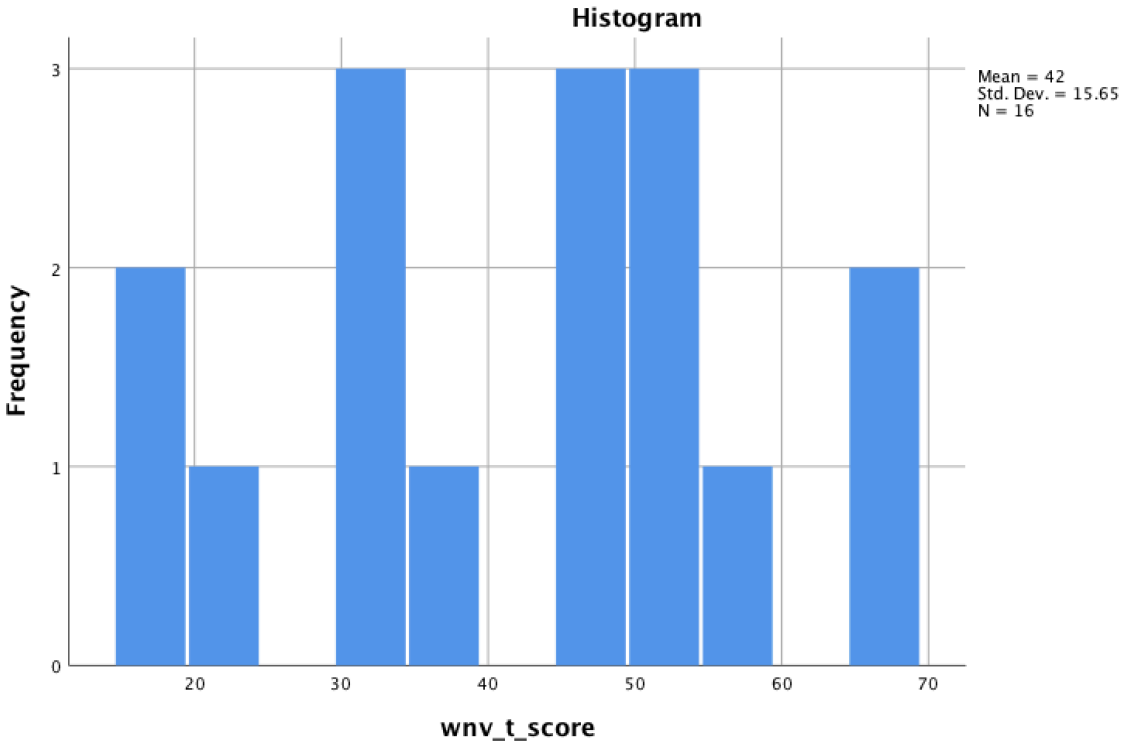
wisc_awm_t_score

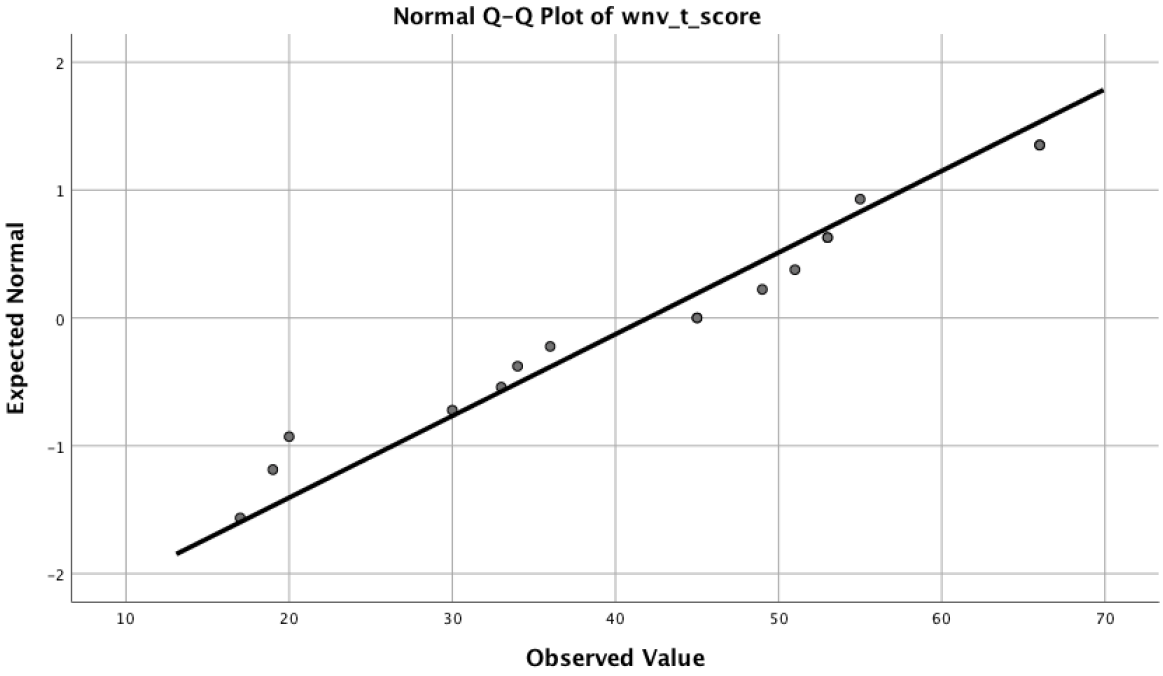


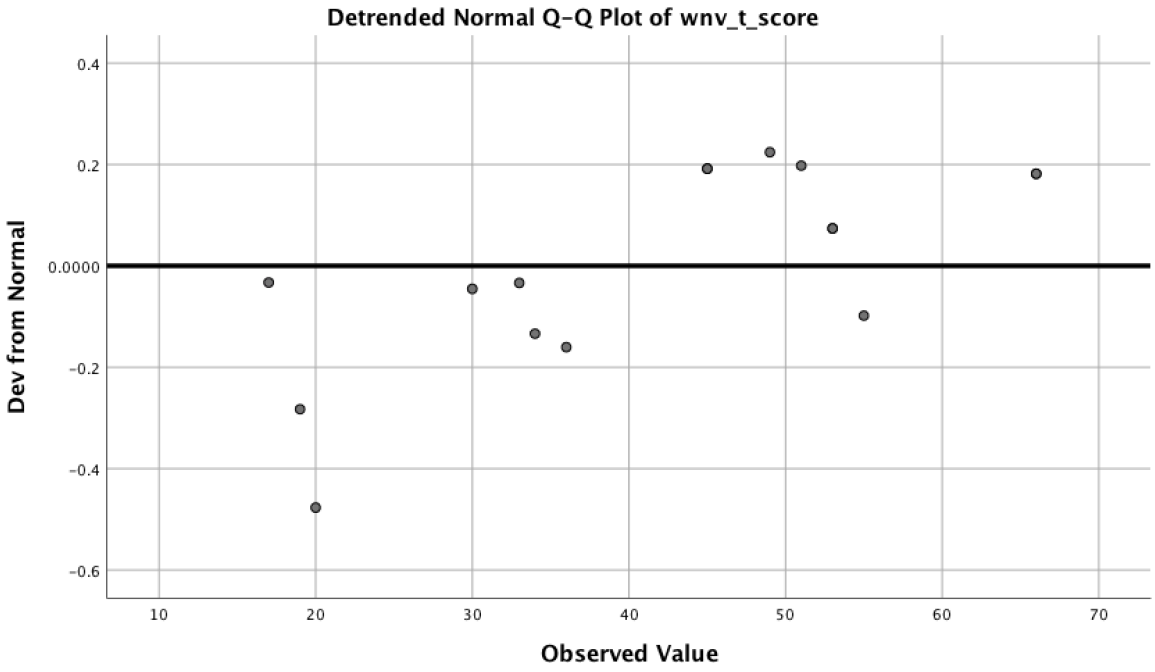

Normal Q-Q Plot of wisc_awm_t_score
Expected Normal
2
1
0
-1
-2
-3
10
20
30
40
50
60
70
Observed Value


Detrended Normal Q-Q Plot of wisc_awm_t_score
Dev from Normal
0.2
0.0000
-0.2
-0.4
10
20
30
40
50
60
Observed Value

wnv_t_score


Histogram
Mean = 42
Std. Dev. = 15.65
N = 16
Frequency
0
1
2
3
20
30
40
50
60
70
wnv_t_score


Normal Q-Q Plot of wnv_t_score
Expected Normal
2
1
0
-1
-2
10
20
30
40
50
60
70
Observed Value




```
NONPAR CORR
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  /PRINT=SPEARMAN ONETAIL NOSIG
  /MISSING=PAIRWISE.
```

Nonparametric Correlations

Correlations

			wmrs_t_score	wisc_wm_t_score	wisc_awm_t_score	wnv_t_score
Spearman's rho	wmrs_t_score	Correlation Coefficient	1.000	-.343	-.208	-.319
		Sig. (1-tailed)	.	.075	.269	.115
		N	19	19	11	16
	wisc_wm_t_score	Correlation Coefficient	-.343	1.000	.989**	.812**
		Sig. (1-tailed)	.075	.	.000	.000
		N	19	19	11	16
	wisc_awm_t_score	Correlation Coefficient	-.208	.989**	1.000	.904**
		Sig. (1-tailed)	.269	.000	.	.001
		N	11	11	11	8
	wnv_t_score	Correlation Coefficient	-.319	.812**	.904**	1.000
		Sig. (1-tailed)	.115	.000	.001	.
		N	16	16	8	16

**. Correlation is significant at the 0.01 level (1-tailed).

```
GET
  FILE='/Users/Kiera/Desktop/SPSS Files & Outputs/RQ3 Analysis Full WISC & WNV Data (Revised).sav'.
DATASET NAME DataSet1 WINDOW=FRONT.
NONPAR CORR
  /VARIABLES=wnv_t_score wisc_wm_t_score wisc_awm_t_score
  /PRINT=SPEARMAN ONETAIL NOSIG
  /MISSING=PAIRWISE.
```

Nonparametric Correlations

[DataSet1] /Users/Kiera/Desktop/SPSS Files & Outputs/RQ3 Analysis Full WISC & WNV Data (Revised).sav

Correlations

			wnv_t_score	wisc_wm_t_score	wisc_awm_t_score
Spearman's rho	wnv_t_score	Correlation Coefficient	1.000	.812**	.904**
		Sig. (1-tailed)	.	.000	.001
		N	16	16	8
	wisc_wm_t_score	Correlation Coefficient	.812**	1.000	.989**
		Sig. (1-tailed)	.000	.	.000
		N	16	19	11
	wisc_awm_t_score	Correlation Coefficient	.904**	.989**	1.000
		Sig. (1-tailed)	.001	.000	.
		N	8	11	11

**. Correlation is significant at the 0.01 level (1-tailed).

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GRAPH
  /SCATTERPLOT(BIVAR)=wisc_wm_t_score WITH wnv_t_score
  /MISSING=LISTWISE.
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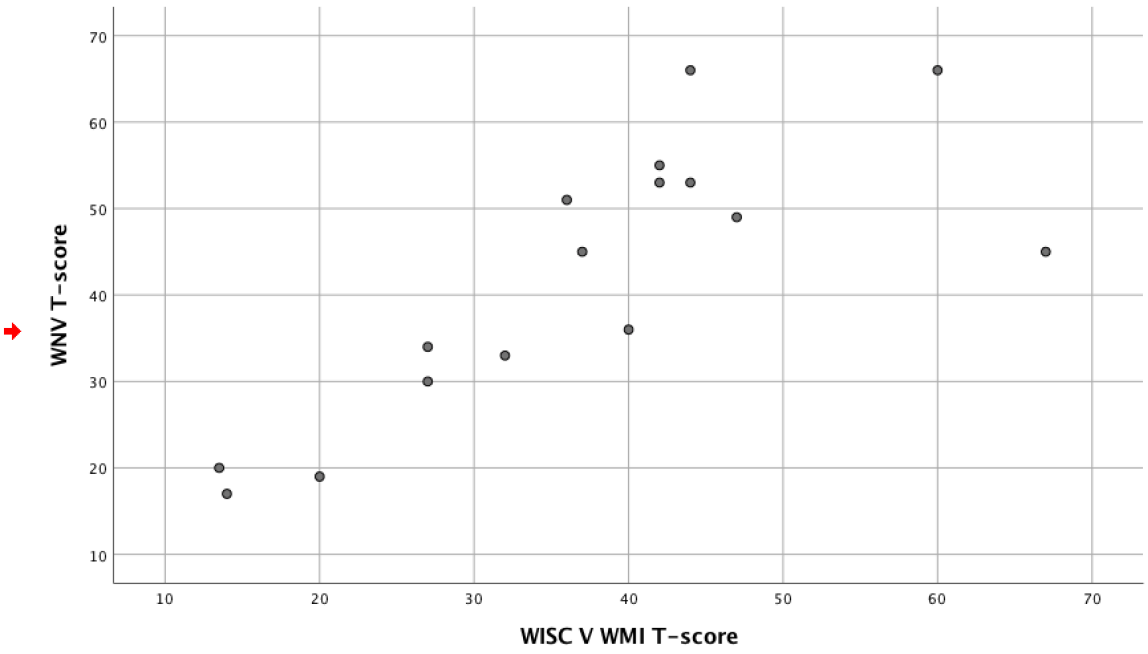
Graph



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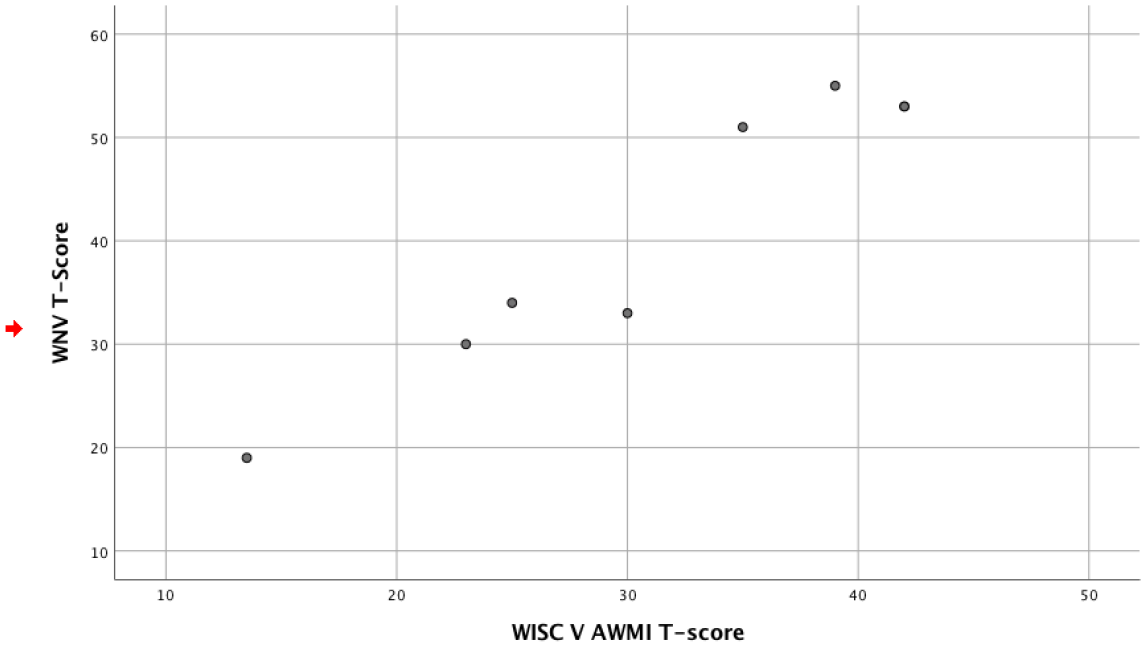
GRAPH
  /SCATTERPLOT(BIVAR)=wisc_awm_t_score WITH wnv_t_score
  /MISSING=LISTWISE.
```

Graph



Appendix 15: Mindmap Linking Coachee Goals to Literature

Appendix 16 : Pre / Post Coaching Self-Efficacy Measure

Teacher Working Memory Knowledge Self-Efficacy Scale

Please think about the child we have identified (Child A) and rate how certain you are that you can do the things discussed below by circling the appropriate number. Your answers will be kept strictly confidential and you will not be identified by name.

Rate your degree of confidence by recording a number from 1 to 100 using the scale given e.g.

0 10 20 30 40 50 60 70 80 90 100
Cannot do Moderately can do Highly certain can do

1. I know what kinds of difficulties Child A has with their learning

0 10 20 30 40 50 60 70 80 90 100
I do not I moderately do I am highly certain I do

2. I know what teaching strategies to use with Child A

0 10 20 30 40 50 60 70 80 90 100
I do not I moderately do I am highly certain I do

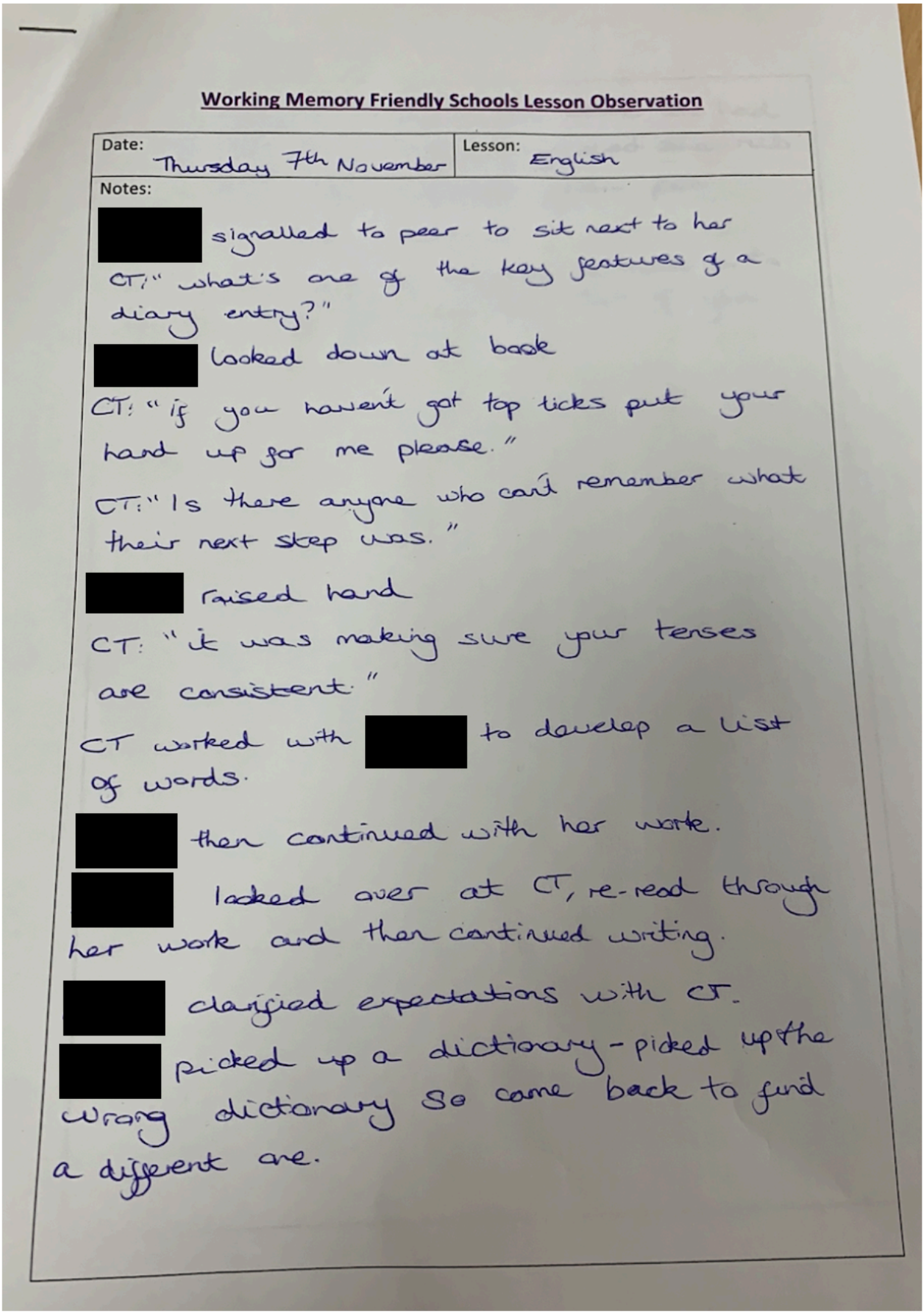
3. I can implement appropriate teaching strategies for Child A

0 10 20 30 40 50 60 70 80 90 100
I cannot I moderately can I am highly certain I can

4. I can identify another child who may have working memory difficulties in the future

0 10 20 30 40 50 60 70 80 90 100
I cannot I moderately can I am highly certain I can

Appendix 17 : Anonymised Example of a Coaching Observation Transcript



Working Memory Friendly Schools Lesson Observation

Date: Thursday 7th November	Lesson: English

Notes:

[redacted] signalled to peer to sit next to her CT; "what's one of the key features of a diary entry?"

[redacted] looked down at book

CT: "if you haven't got top ticks put your hand up for me please."

CT: "Is there anyone who can't remember what their next step was."

[redacted] raised hand

CT: "it was making sure your tenses are consistent."

CT worked with [redacted] to develop a list of words.

[redacted] then continued with her work.

[redacted] looked over at CT, re-read through her work and then continued writing.

[redacted] clarified expectations with CT.

[redacted] picked up a dictionary - picked up the wrong dictionary so came back to find a different one.

Interview

Teaching adaptations include:

- Individual adaptations ie. recapping work with the student
- Breaking tasks down
- Repetition

Do the above to build confidence, fluency and emotional wellbeing.

WM as a "buzzword"

What We Know About Child X From The Assessment Work

Better on kinaesthetic working memory tasks than auditory or visual WM tasks.

Auditory short term memory was better than auditory working memory.

GOALS:

1) To help learners with working memory difficulties to increase their independence.
2) To help learners with working memory difficulties increase their self-esteem and confidence
3) To develop a better understanding of working memory.
4) Help for those who don't have more specific SEN support but still have some needs / barriers with their learning.

Building on Strengths ie. modelling is beneficial

Baddeley (2010) Working Memory model and the visual → verbal shift that takes place as children develop.

Chunking / breaking down tasks to reduce cognitive load ie. top ticks

Visuals ie. word banks, green semi colon sheets

COACHING

Links between WM and self-esteem and independence

- Peer memory buddies

↓

META COGNITION (autonomy)
EEF & Cambridge (Feuerstein)

Importance of Effortful Mental Transformation of information ie. doing something with the information before memory decay.

Instructional Hierarchy (Haring & Eaton, 1978)

How child X transfers / generalises their learning from teacher input → class work

Ebbinghaus Forgetting Curve

Week 1 Goal:

Child X to follow teacher input and transfer her knowledge so she can write a paragraph independently.

→ Breaking down / chunking tasks ie. top ticks was noted as helpful.

Week 2 Goal:

- Child X to structure a piece of writing with support and carry this out independently
- Child X to seek and use a strategy independently before asking others for help.

→ Child X's independence as a learner was noted to have improved. It was discussed that this may be linked to whole-class resilience / autonomy discussions.

Week 3 Goal:

Child X to structure a piece of writing with support and transfer learning / strategies to her own work

→ With modelling and teacher support to structure (and help Child X start) the work, Child X was able to complete a fact file task independently

Appendix 19 : Post Coaching Questionnaire

EVALUATION OF COACHING

This form is divided into three sections. Part One asks you to rate how well you and your coach worked together. Part Two asks you to indicate the impact of the work and Part Three asks some general questions. For Part One and Part Two, please mark the appropriate box in each row to indicate the extent to which you agree with the statements.

PART ONE – How well you and your coach worked together

Please tick the appropriate boxes

	Very Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Very Strongly Disagree
We had a good rapport.						
We agreed the goals I was working towards.						
I got the sense that we were "on the same page."						
The things we did were helpful.						

You can add any additional comments about the above if you wish:

PART TWO – The impact of the work

Please tick the appropriate box in each row

The coaching has had a positive impact on my…	Yes	No	Not Applicable
Teaching (or aspects of it).			
Personal and/or professional development.			
Well-being at work.			
Ability to help myself in future.			

Please elaborate on any impact below:

PART THREE – Post Coaching Goal Attainment Examples

Please tick the box which best describes your experience of coaching.

		Level of Expected Outcome	Tick	Rating
My understanding of children's working memory has improved since undertaking coaching	YES	Much more than expected		+2
		More than expected		+1
		As expected		0
	NO	Less than expected		-1
		Much less than expected		-2

If you rated the above question as "Expected", "More than expected", or "Much more than expected" what new knowledge have you gained?

		Level of Expected Outcome	Tick	Rating
My ability to identify children with working memory difficulties has improved since undertaking coaching	YES	Much more than expected		+2
		More than expected		+1
		As expected		0
	NO	Less than expected		-1
		Much less than expected		-2

If you rated the above question as “Expected”, “More than expected”, or “Much more than expected” what new knowledge have you gained?

My ability to adapt my teaching to take account of working memory approaches has improved since undertaking coaching		**Level of Expected Outcome**	**Tick**	**Rating**
	YES	Much more than expected		+2
		More than expected		+1
		As expected		0
	NO	Less than expected		-1
		Much less than expected		-2

Taking part in coaching has changed some aspects of my teaching practices.		**Level of Expected Outcome**	**Tick**	**Rating**
	YES	Much more than expected		+2
		More than expected		+1
		As expected		0
	NO	Less than expected		-1
		Much less than expected		-2

If you rated either of the above questions as “Expected”, “More than expected”, or “Much more than expected”, please briefly detail what you have changed / adapted in your teaching practice.

Would you recommend coaching for other teachers who may have children with working memory difficulties in their class?

Please tick the appropriate box below

Yes	Unsure	No

Please explain your answer:

What changes have you made in the classroom as a result of using working memory knowledge and coaching?

If you would like to make any other comments, you can do so overleaf.
Thank-you for taking the time to complete this questionnaire.
Please return to the researcher.

"Working Memory Friendly Schools" Coaching Follow Up Survey

0%

1. Did taking part in the coaching have a positive impact on your personal or professional development? *

- ○ No
- ○ A Little
- ○ A Lot

Next Page

14%

2. Is anything that we discussed about working memory in the coaching sessions still useful or relevant to your teaching practice?

- ○ Yes (If yes, please briefly detail which information is still most useful / relevant?)
- ○ No (If no, please briefly state why not.)

Comment:

Previous Page Next Page

29%

3. Are you currently using any knowledge about working memory gained through the coaching in your planning or teaching?

- ○ Yes, I adapt my planning and teaching based on working memory knowledge (If yes, please briefly state how you use your knowledge, what aspects you have found most helpful, and how these inform your planning / teaching.)
- ○ No, I do not (If no, have there been any barriers / reasons why not?)

Comment:

Previous Page Next Page

43%

4. Have you shared any of the working memory knowledge you acquired through coaching with other colleagues?

- ○ Yes (If yes, what aspects have you shared with others?)
- ○ No (If no, have there been any barriers / reasons for this?)

Comment:

Previous Page Next Page

57%

5. Do you feel confident to identify other children who may have working memory difficulties since undertaking the coaching? *

- ○ Yes
- ○ No

Previous Page Next Page

71%

6. If coaching was available for another colleague, would you recommend it as an intervention and a learning opportunity? *

- ○ Yes
- ○ No

Previous Page Next Page

86%

7. Do you have any other comments or reflections on taking part in this research?

8. If you are happy to, please include your initials in the box below.
This will allow the long term impact of the coaching to be considered for each individual case.
Thank you! :)

Previous Page | Finish Survey

Appendix 21 : Certificate of Ethical Approval

UNIVERSITY OF EXETER

GRADUATE SCHOOL OF EDUCATION

St Luke's Campus
Heavitree Road
Exeter UK EX1 2LU

http://socialsciences.exeter.ac.uk/education/

CERTIFICATE OF ETHICAL APPROVAL

Title of Project: "Working Memory Friendly Schools": Educational Psychologists Using Coaching with Teachers to Improve Knowledge About Working Memory Difficulties in Primary Schools

Researcher(s) name: Kiera Farelly

Supervisors: Professor Brahm Norwich
Margie Tunbridge
Lata Ramoutar

This project has been approved for the period

From: 30/04/2019
To: 31/08/2020

Ethics Committee approval reference: D1819-045

Signature: Justin Dillon Date: 18-04-2019
(Professor Justin Dillon, Professor of Science and Environmental Education, Ethics Officer)

Appendix 22 : Summary of Observed Classroom Behaviour

Teacher's reported observations of behaviour for students who have difficulties with their learning (and therefore may have possible working memory difficulties).

Teacher	Observed Behaviours in the Classroom
Rachel	• Student appears distracted which impacts on completing everyday classroom tasks such as writing. • Processing speed is affected. • Student struggles with retention over time and transferring learnt skills to other tasks. • Difficulties are observed across the curriculum and affect organisational skills.
Gemma	• Classroom tasks, including those in a SEN provision place demands on memory and retention. • Student is not listening and masks their difficulties. • Student would be waiting for, and accepting of adult help. • Difficulties are apparent across the curriculum but the student displays strength in creative subjects such as Art.
Zoe	• Student appears to be daydreaming and does not follow instructions. • Student struggles to process multiple steps of information. • Student may engage in avoidance behaviours or appear distracted. • Difficulties are apparent across the curriculum but particularly notable in subjects which require attention and focus.
Chrissie	• Student is well-behaved in class but struggles to focus or remember and consequently becomes frustrated and disappointed. • Students struggle to process multiple pieces of information. • Difficulties are shown across the curriculum but particularly in literacy and numeracy.
Matthew	• Student lacks focus and may be daydreaming (passive presentation) or talking to peers (active presentation). • Student may be waiting for help from adults. • Difficulties are apparent for all written tasks.
Caroline	• Student struggles to retain learning over time.

	• Difficulties impact on day to day classroom tasks e.g. sentence structure. • Student is unsure how to begin a task and doesn't always ask for help. • Student seeks clarity and reassurance across all lessons, although difficulties are particularly apparent in maths.
Jamie	• Student struggles to maintain focus. The student is aware of this and can appear introverted and reserved. • If the student makes mistakes, they can become frustrated. • Creative tasks are beneficial for this student. • Difficulties are observed across the curriculum.
Jo*	• Student struggles to engage, stay focused or stay on task. • Student finds it hard to follow instructions or routines, particularly if there is multiple stimuli around the classroom that they have to process. • Difficulties are observed across the curriculum and school day.
Victoria*	• Student finds it difficult to follow instructions independently. • Is "in a world of their own" • Finds it hard to place themselves back on track if distracted e.g. if copying from the board. • Difficulties are most evident in lessons with complex instructions, lessons that are longer and lessons with fewer visual prompts.
Jack*	• Student has a short attention span and is easily distracted. • Likes to move around the classroom e.g. will move onto other tasks if loses interest in something.

** Teachers who did not undertake coaching in Phase Three.*

Appendix 23 : Summary of Teaching Adaptations

Teacher's reported teaching adaptations for students who have difficulties with their learning (and therefore may have possible working memory difficulties).

Teacher	Teacher Adaptations
Rachel	• Physical memory aids such as a marker to aid with keeping place when writing, visual now / next support, short activities, time for processing and learning breaks. • Adaptations have a positive impact on focus, organisation and student self-efficacy. Aim of such adaptations is to improve independence, resilience and self-esteem. • Teacher CPD is important but there are financial and time constraints that limit this. Contact with other professionals is limited.
Gemma	• Teaching adaptations include adult support or modelling, practical tasks, individual workstations and chunking information. • Adaptations are intended and thought to support processing, and promote student independence, engagement and empowerment. • Desire for teacher learning and CPD.
Zoe	• Teaching adaptations include prompts and differentiation, although there are competing classroom pressures and a threshold of need for support. • Teaching adaptations are intended to improve memory, build independence, increased student self-confidence and ensure progress with learning. • Support and ideas for teaching adaptations from other colleagues is valued.
Chrissie	• Teaching adaptations may include breaking tasks down into chunks, or repetition, but they are individualised rather than whole class based. • Teaching adaptations aim to build learning (fluency and retention), emotional wellbeing (student confidence, empowerment and self-belief) and allow students to access their learning.
Matthew	• Teaching adaptations include breaking down tasks and light touch adult support.

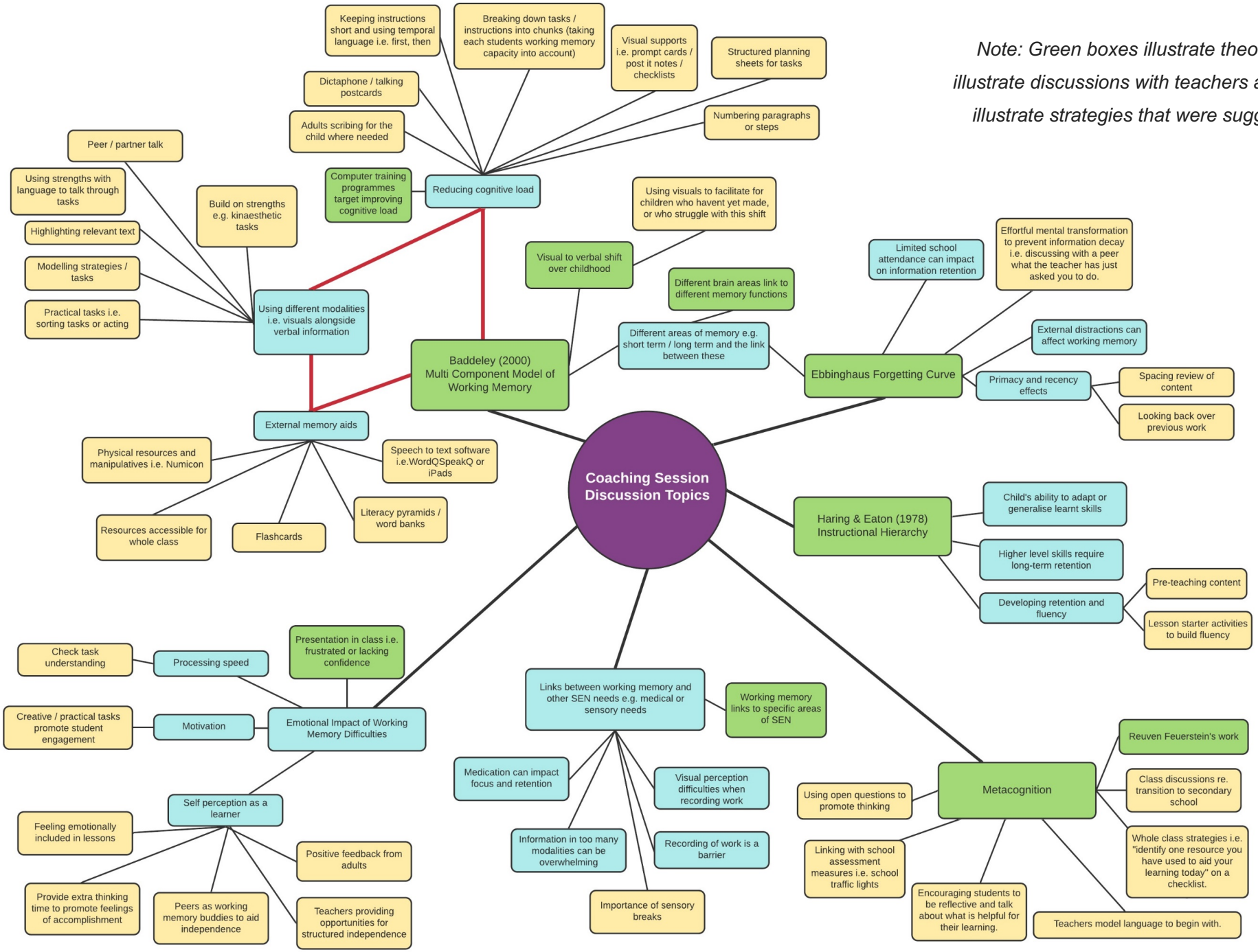
	• Teaching adaptations aim to ensure student understanding and academic progress. • Support and ideas for teaching adaptations from SENCo but little contact with external professionals.
Caroline	• Teaching adaptations include adult support or modelling, chunking tasks or information, kinaesthetic / practical tasks, prompts and differentiation. • Adaptations are to promote consolidation of learning and fluency. • Teaching adaptations have to be personalised for both teacher and student. This has resulted in teachers adapting to support specific students. • Desire for teacher CPD to improve teaching. • Engagement in research is important.
Jamie	• Teaching adaptations include adult support, differentiated tasks and adapting instructions by breaking them down as needed. • There are tensions with providing this adult support and possible negative impacts include overreliance. • Teacher adaptations are done to find out what the student can do independently, help the student to be secure in their learning, achieve the learning objective and promote a sense of inclusion. • Teacher CPD is important to support students. This may be through sharing knowledge with colleagues, taking part in research or increased awareness of working memory.
Jo*	• Teaching adaptations include adult support, workstation in class, breaking down instructions, kinaesthetic resources i.e. Numicon and interventions to target specific skills i.e. phonics. • Teaching adaptations have a positive impact and are done to aid focus, aid progress and ensure student achieves learning objectives. • Memory games may help to improve cognitive load capacity. • Teacher CPD and raised awareness of working memory is important. • Adaptations are based on implicit knowledge rather than research based.
Victoria*	• Teaching adaptations include light touch adult support or monitoring, catch up sessions, breaking down instructions and using visual resources.

	• Teaching adaptations are done to aid academic progress, aid focus and help students to achieve their potential. • Possible negative impacts of adult support include a tension and fine balance between interfering or supporting. • Memory games may help to improve cognitive load capacity. • Teacher CPD and raised awareness of working memory is important to support students. • Adaptations are based on implicit knowledge rather than research based.
Jack*	• Teaching adaptations include fidget toys, adult support consistently throughout the lesson to, practical tasks, visual or kinaesthetic resources, giving clear instructions and specific seating plans to aid concentration. • Teaching adaptations are done to aid focus, keep students on task and help them to access content. • Teacher CPD is valued. • Adaptations are based on implicit knowledge rather than research based.

** Teachers who did not undertake coaching in Phase Three.*

Appendix 24: Research Informed Discussions From All Coaching Sessions

Note: Green boxes illustrate theory, blue boxes illustrate discussions with teachers and yellow boxes illustrate strategies that were suggested or tried.



Appendix 25: Qualitative Comments From Post-Coaching Questionnaire

How Well the Coach and Coachee Worked Together

Coachee*	Comment
Chrissie	"*I felt we worked well together and were on the same page on the goals to set and how to reach them. I also felt that you worked intuitively to gauge my teaching style and suggest methods and ideas which worked well with that. You had a great understanding of what was manageable and we set targets in accordance with this. I never felt that what was set was unachievable but there was always something constructive to develop*."
Caroline	"*A very welcoming and non-judgemental environment that allowed for a productive and positive conversation about our developing knowledge of working memory*."
Gemma	"*Kiera was really helpful and talked through aspects of what working memory was. Her questioning made me think about what happens within the classroom and for the children studied*."

The Impact of the Coaching on Different Areas of Teacher Development

Coachee*	Comment
Zoe	"*It has been really helpful to be able to look more in depth and has had a very positive impact on my professional development*."
Chrissie	"*Working with you was very helpful. I felt that I came away from each session with clear goals and ways to reach them with the pupil. We also worked on whole class approaches which could help a range of pupils. I have found that the methods and techniques we discussed have worked well in my teaching approach and have been easy to add into my daily practice*."
Caroline	"*Opportunity to reflect upon our own practice was beneficial*."
Gemma	"*Identifying how the children may not always hear and retain info e.g. when stimming as now we repeat information once stimming has finished*."